# Railway Mechanical Engineer

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### Completing the Machine Tool

When a railroad buys a machine tool, it has, practically speaking, not purchased a complete tool at all, but merely the transmission by means of which mechanical power may be delivered to the cutting tool, and a foundation sufficiently rigid to support satisfactorily the object on which the cutting tool is to operate. These machines have possibilities for output and economy in labor time the full realization of which is the real object for which they are purchased. Before these possibilities can be realized, however, much ingenuity must be devoted to the development or selection of facilities for holding the work, to the proper tooling, and in some cases to both. It is generally admitted that it would be folly to attempt to develop a substitute for these highly specialized machines in the railroad shop. When it comes to the tooling, however, including the proper selection of jigs and fixtures, many roads depend on the ingenuity of the men in the shop, notwithstanding the fact that these men are not specialists and that they must necessarily go over much that is old ground to the manufacturer. The latter, in the interest of making the best possible showing for his machine, is constantly scheming to determine the most effective method of utilizing it in the performance of a wide range of operations, and what he has to offer is generally the cumulative result of years of development, just as is the machine itself. The interest of the purchaser in securing the largest possible return from his investment in the machine tool demands that he give at least as careful consideration to those facilities required to make the tool complete as he does to the selection of the machine itself. He has not fully served this interest until he has thoroughly investigated the possibilities for service in recommending or furnishing these extra facilities which the manufacturer himself has to offer.

### The Value of Service Literature

Practically every shop man is familiar with the improvements which are constantly being made in the design and construction of machine tools. He may not know just how these improvements are brought about, but if he can visualize a large research laboratory where engineers experiment with new ideas, he will see a large scrap pile which is the last resting place of unsuccessful experiments. But from out of this effort and material comes one improvement after another, which tends to make this particular scrap pile an index to progress. In order to make the results of such work available to others, the data and information obtained is compiled and published in the form of instruction books, or what is generally known as trade literature. This type of literature is not new. In fact one expects it to come with a milling machine or locomotive stoker, as it does with an automobile or washing machine. Sometimes it is read and sometimes it is not. Perhaps such carelessness is due to the memory of some earlier trade publication which seemed to contain only information which was neither needed nor wanted. Yet, as better machine tools are being built, so are the instruction books and various other kinds of service literature improving.

This fact has been brought to our attention in the report of a large machine tool manufacturing company, which has spent a considerable amount of money and devoted many hours to improving its instruction books, part lists and other printed material, classed as service literature. It has given this work an important place in its research and publicity departments and as a result it is able to furnish complete and reliable information on any subject relative to its machine tools. This service makes it easier for the man who has to run the machine and also procures better results for his employer.

What has been said in this particular case is true for many manufacturing concerns. The data and information contained in service literature is not only the result of research work but it is based on the experience of many customers as well. Such material is invaluable to the railroad shop man.

### Main Objective in Locomotive Repair Work

It is advisable that locomotives be handled quickly through repair shops and engine terminals in order that they may be returned to revenue service as soon as possible and also that the labor cost of repair operations may be reduced to a minimum. Continued pressure for reduced shop operating costs, however, may be productive of highly undesirable results unless at the same time it is made clear that the quality of material and workmanship entering into the repair of locomotives is now and always will be of even greater importance.

This point was strongly emphasized by H. T. Bentley, general superintendent of motive power and machinery of the Chicago & North Western, in addressing the International Railway General Foremen's convention held at Chicago, September 9 to 12. Mr. Bentley said, "Thoroughness in doing necessary work to locomotives in shops will probably reduce the shop output somewhat but materially improve the service and decrease the cost of enginehouse maintenance. Slovenly and improper work increases failures on the road and is not an economical proposition notwithstanding records of low costs in the shops." In other words, it is not so much *how quickly* locomotives can be put through repair shops, but *how long* these locomotives will stay in service after leaving the shops.

Obviously the attitude of shopmen, gang leaders and foremen toward the quality of their work is a reflection of the attitude of the general foreman, shop superintendent and higher mechanical officers. If any shop management places its record for output ahead of its record for thorough going, reliable repairs, inferior locomotives are bound to be turned out. For example, suppose that after a locomotive is wheeled, the right main wheel is discovered to be 1/16 in. or possibly 1/8 in. ahead or back of its proper position, due to an error in lining the shoes and wedges. The erecting shop foreman in charge of that engine has two options. He can drop the

wheels, make the necessary changes in the right main shoe and wedge either by means of shims or by waiting until a new shoe and wedge can be planed to the proper dimensions, the main wheels then being placed back under the locomotive. The other option, and the one which will be chosen by the average foreman on whom too much pressure is brought for output, will be to overlook the error, or at least take care of it temporarily by adjusting rod lengths. What is the result? This locomotive is placed in service and perhaps in a single week develops sharp flanges which necessitate tying up the locomotive at an enginehouse while tires are being turned or in some cases renewed.

There are always some men in any organization who will do just as poor work as they can get away with and there is need for a continued check, therefore, on the quality of locomotive repair work in order that locomotives may be maintained in condition for safe and efficient operation. Honesty is the best policy in railroad shop operation as in all other lines of business and shop foremen must be encouraged to place the proper emphasis on high grade workmanship, always correcting the errors which are bound to occur occasionally, and not trying to fool themselves and their superiors by covering up defective workmanship.

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### Competition for Foremen

The foreman, under the most efficient form of organization, forms the keystone to the arch. If his strategic position is not recognized and if full advantage is not taken of it, then the organization is sure to suffer and to function at a low efficiency. "The Shop Man," published by the Michigan Mutual Liability Company, recently published the following material about the foreman:

THE FOREMAN

BY A CORPORATION PRESIDENT

Some people think
The president of a
Corporation has to
Know a tremendous lot.
But take it from
Me, he don't. I know,
Because I'm one,
And I know that
When an important
Matter comes up I
Always send for the
Vice-president, and
He sends for the general
Superintendent, and he
Sends for the department
Superintendent. The department
Superintendent sends for
The foreman. "Bill," says he,
"What shall we do and how?"
Does Bill send for any one?
Well, I guess not! Bill knows.
That's why the foreman
Has such an important
Job. He's got nobody
To ask. He just has
To know the answer.
If anybody asks
Me who runs our
Corporation, I answer,
THE FOREMAN.

There has been a considerable change in the status of foremen on the railroads in recent years. The loyalty and ability shown by many of these men in the crisis two years ago was in some instances responsible for this. Then, too, there has been a growing consciousness of the importance of the foreman in industry, as well as on the railroads, for the past several years. To focus attention on this development and emphasize it, the *Railway Mechanical Engineer* is offering a first prize of $50 and a second prize of $35 for the two most constructive articles on the opportunities and responsibilities of foremen which may be received at our office in New York on or before December 1, 1924. The first announcement of this competition was made in our October issue, page 578. It is not so much our intention to develop information as to detailed methods and practices, as it is to illustrate the strategic position occupied by the foreman and his opportunities for strengthening the organization and making it function more efficiently.

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### Suggestions for Future Conventions

Six conventions of minor mechanical department officers were held in five consecutive weeks in Chicago beginning the last week in August and extending through the month of September. In order that the papers and discussions presented at these conventions might be available to railroad men as early as possible the *Railway Mechanical Engineer* made a special effort and included a considerable proportion of each convention report in its October issue, holding certain papers for the November and subsequent issues. The convention reports referred to and their location in the October *Railway Mechanical Engineer* are as follows: Traveling Engineers' Association (page 578 to 594), Chief Interchange Car Inspectors' and Car Foremen's Association (page 608 to 613), International Railroad Master Blacksmiths' Association (page 619 to 620), American Railway Tool Foremen's Association (page 621 to 623), Painting Section, Mechanical Division (page 624 to 629), and International Railway General Foremen's Association (page 629 to 636).

The aggregate cost of these conventions to the railroads and to the supply companies maintaining exhibits is large and yet most progressive railroad officers consider the expense justified. It is hard to put a dollars and cents value on some of the returns from convention attendance such as increased general knowledge of the best practice on other roads, the broadening influence of meeting other experienced, practical men in the field and the educational value of studying new machinery and equipment developments first hand. The fact cannot be denied, however, that in many a case, a master painter, car foreman, traveling engineer or other railroad man carries home from the convention two or three new, intensely practical ideas, the application of any one of which in his own particular department saves the railroad many times over the cost of sending him to the convention. This man in some cases (we hope they are few) has been compelled to pay his own expenses, except transportation, and to lose the time while away from his job.

Strong belief in the general value of the minor mechanical associations mentioned does not imply that their conventions cannot be improved. In fact the *Railway Mechanical Engineer* has heard specific criticisms of two of the association meetings, a brief mention and consideration of which may be of benefit in planning future meetings. These criticisms include the absence of advance papers, sessions too short or only one session a day, superficial discussion, lack of encouragement to bring out opinions of quiet members and lack of definite action regarding standards of practice.

There can be no question as to the advisability of providing advance copies of the papers to be presented, otherwise the discussion is almost sure to be superficial. The practice of handing six or eight blue prints of a device about the convention floor and then reading a paper referring to the blue prints has little to commend it. It is doubtful if mechanical department men, accustomed to more or less continuous, active effort, can sit down in a smoke-filled

room and concentrate on a given subject for more than two or possibly three hours. On the whole, it would seem more advisable to have one relatively short session in the morning and another in the afternoon rather than to try to complete the work in a single long morning session. Investigation shows that four of the six associations hold two sessions a day, while the other two hold only single sessions. One point must never be forgotten and that is that the conventions are intended primarily for business, and the members should be willing to work at least as many hours in the convention hall and among the exhibits as they do on their regular jobs. None of the associations can long survive if their members, coming from points as far distant as California and Florida spend three hours a day discussing business and amuse themselves or are entertained the rest of the time.

It is of course true that many association members do not feel equal to the task of expressing themselves on the floor. If they failed to make themselves heard at any of the conventions this year, however, it was not for lack of opportunity afforded them by the chairman. In most cases they are permitted to submit written discussions, after returning home, for inclusion in the proceedings.

Much can be said on both sides of the question of adopting recommended standards of practice. Presumably such standards would be put in the form of recommendations to the Mechanical Division. Too great standardization has a deadening effect and tends to reduce the general average of efficiency. On the other hand, there is a vital need of more uniform practice in some essentials and a more general knowledge of the best practices of the various roads. The real function of the specialized mechanical associations is in the spread of this knowledge. For example, some roads report great success with a certain device; other roads do not use it. A determined effort should be made by the association interested to bring together all possible information regarding this device, outline limiting conditions, and in this way prevent one road adopting a device which has been proved a failure on another.

It is to be hoped that the officers of these associations when planning for their 1925 conventions will outline constructive programs, spend every effort to secure men who are interested and competent to present papers on the various subjects and give a great deal of thought to enabling those who attend the conventions to obtain the maximum benefit from the time expended. Almost without exception the association memberships are far below the desired point and active membership campaigns should be inaugurated during the coming year. Get the advance papers out early and ask the members to bring prepared discussions. The 1925 conventions can be made the best attended, most instructive meetings ever held by these associations. They should be.

## New Books

Pulverized and Collodial Fuel. *By J. T. Dunn, D. Sc. (Dunelm.), F. I. C., Consulting Chemist, Newcastle-Upon-Tyne, 197 pages, illustrated, 7 in. by 9¾ in. Price* $6.00. *Published by Van Nostrand Company, Eight Warren Street, New York.*

A large part of the book consists of descriptions of actual plants, involving engineering details as well as the chemical processes involved in using pulverized fuel. The author has endeavored to present these underlying principles and to give a fair account of the advantages and disadvantages, as they appear to him, accompanying the use of powdered fuel for various purposes. The first few chapters are devoted to a discussion of the combustion of coal in the lump and powdered state and a chemical explanation of the unit of heat. Crushing and forms of crushers; drying; dangers involved in drying; various types of machinery used for pulverizing and the power required to operate these machines, are comprehensively discussed in the chapter dealing with the preparation of powdered coal. The relative advantages of different systems of transporting powdered coal from the pulverizers to the storage bins are adequately explained. The various methods of burning the fuel and the best ways to handle the ash disposal are next taken up in the book. The comparative costs of operating various types of powdered fuel plants along with the advantages and disadvantages incurred in their operation are ably set forth. The last chapter deals with the general properties and manufacture of collodial fuel. The text of the book is well illustrated with drawings and photographs.

Coke and Its Uses. *By E. W. L. Nicol, 134 pages, 6½ in. by 9½ in., bound in cloth. Published by D. Van Nostrand Company, New York. Price* $5.00.

Because of the fact that existing steam boilers and furnaces as well as mechanical stokers, with a few exceptions of comparatively recent origin, have been designed upon a coal fuel basis it is conceded that coal is likely to remain the chief source of heat and power. The use of coke, however, has attracted much attention, and in this book the author, who has had many years of specialized experience in adapting coal-fired steam boilers and other heating apparatus to the use of coke, has presented in non-technical language a practical treatise on coke production and its application as fuel not only to steam power plants and large steam generating units but to domestic use as well. The possibilities of the use of coke as fuel and the relative efficiency as compared with coal has been given a thorough discussion. This volume contains 12 plates and 22 illustrations in the text showing the general arrangement as well as details of design of coke-burning installations.

Condensed Catalogues of Mechanical Equipment—1924-1925 *758 pages, 8¼ in. by 11¼ in. Flexible binding. Published by the American Society of Mechanical Engineers, New York. Price* $5.00.

The fourteenth annual volume of the Condensed Catalogues of Mechanical Equipment presents to the mechanical engineer, executive or purchasing agent a valuable source of comprehensive information. The catalog section contains 527 pages of data describing the products of 430 firms, an increase of 60 firms as compared with 1922 edition. This section, in seven parts, contains an alphabetical index and catalog data on power plant equipment; testing, measuring and recording apparatus; power transmission machinery; conveying, hoisting and transporting machinery; metals, alloys and other materials; machine tools and shop equipment and finally, compressing, pumping, hydraulic and industrial machinery.

The directory section is alphabetically indexed with convenient cross references and the inclusion of trade names in the index serves as an additional aid in locating particular equipment. Under each heading have been entered the names and addresses of representative firms which manufacture that particular line. Some idea of the scope of this volume may be gained when it is considered that there are 3,900 classifications of equipment and 4,400 firms listed in the mechanical equipment directory section alone.

The final section is the professional service directory in which is classified the specialized lines of practice of A. S. M. E. members engaged in professional service work and the catalog pages describing the qualifications, achievements and special services offered by various individuals and organizations. In the directory are listed 575 engineers and 346 classifications. The edition as a whole, although large in size is light in weight and easily handled.

# What Our Readers Think

## Question on Switch Engine Service Answered

ST. JOSEPH, MO.

TO THE EDITOR:

Three questions as to the length of service that should be obtained from a new set of side rod bushings, a new set of tires and a set of two-inch driving box crown brasses equipped with grease cellars on an eight-wheel switch engine, working 24 hours a day, 315 days a year, were raised by "Shop Foreman" in your September issue. In the first place, if you have any switch engine or any other locomotive that will do 24-hour service 315 days in the year, you should nurse it like a baby and give it anything it needs. Counting the time out of service for daily inspections, washing the boiler, cleaning the flues, quarterly and yearly tests, one would think that all the time left, after making the necessary repairs, would be about 275 days a year.

The questions asked are ones that cannot be answered alike by all roads. But on our division a set of rod brasses, on the type of locomotive referred to, is giving one year's service. We have three of these heavy switch engines and it is seldom that the rod brasses have to be replaced between shoppings. We shop these locomotives about once a year for heavy running repairs. Much depends on the condition of the shoes and wedges. The brasses will last much longer if the shoes and wedges are kept up than if you try to keep the shoes and wedges up with the rods. True crank pins are another important factor in determining the life of rod brasses.

Tires, like any other part of the engine, depend largely on the service they must perform. First, one must have careful enginemen and second, such locomotives must work on fairly straight track. If there are many sharp curves to be traveled in a day's service with only 1-32-in. cutting per month, then you are getting a very good average, and according to federal inspection, the tires would not have to be trued or turned for a year.

Crown brasses are renewed about once every two years on our locomotives. They are put in the machine and trued up about once a year and replaced every two years.

E. C. JACKSON.

## Rating Personal Characteristics of Apprentices

TO THE EDITOR:

The articles on apprenticeship which have appeared in recent issues of the *Railway Mechanical Engineer* should be interesting to all mechanical officers, industrial as well as railroad. There is a great need in this country for more regular apprentice training in all the mechanical trades.

On page 531 of the September issue, is shown a personal characteristic card, which, I take it, is made out by the apprentice instructors. Just how is this marked?

Take "Honesty," for instance. How much dishonesty would one be guilty of to be poor and just how would the distinction be made between poor, medium, good, etc? I know it is possible to grade eggs in such a manner, but would it not be rather difficult with boys? In the case of "Morality," how would medium and poor morality be defined? "Temperance," I take it, refers to the amount of intoxicating liquors used. Is it not difficult to differentiate between "Initiative" and "Resource"?

Some of our apprentices who have read these articles have asked me to show them how to mark one of these cards, and I must confess my inability to do so. This request is not made in any attempt to be facetious at all, but with an honest desire to learn something that possibly the writer should already know as he has been rating boys for over 30 years.

OBSERVER.

The following reply to Observer's inquiry from an apprentice instructor who has been using the personal characteristics card referred to will be of interest to all who are engaged in personnel work whether with apprentices or other employees.—EDITOR.

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TOPEKA, Kan.

TO THE EDITOR:

The question raised by Observer relative to the personal characteristics card published in one of the articles on Apprenticeship Methods on the Santa Fe is partly answered in the same article, on page 528 of the September issue, in the description of records maintained.

These forms are filled out by apprentice school and shop instructors, each without the assistance of anyone else. The purpose of this report is to obtain the unbiased opinion of the one making it out and to insure his making an intimate and careful study of the personal characteristics of each apprentice in his charge. Knowing that he must make a written report on each boy, he naturally studies them more thoroughly and thus becomes more familiar with each boy's good and bad traits and also with the best avenues of approach to his mind and heart. He is thereby better enabled to render help where needed and in the manner in which his assistance will be most effective.

It is not expected that the reports from the different instructors will at all times agree nor even that those by the same instructor at different times will be identical. These will vary with the accuracy of the knowledge gained as to each boy's real characteristics and with the interpretation of the terms used. But even though the instructor may err in his judgment of the boy, the study of these characteristics will have been worth while.

Observer says that some of the apprentices who have been reading these articles have been trying to fill out the cards for themselves. That is fine. Would it not do all of us good occasionally to go off by ourselves and seriously check up our own honesty, morality, tact, resourcefulness, reliance, foresight, appearance, memory, energy, industry, initiative, persistence, assertiveness, promptness, accuracy, personality, loyalty, popularity with authorities and associates—whether we are making good and living up to our ideals? Even though we may err in our judgment of our own personal characteristics, the study, if honestly made, will have been worth while and we will be better enabled to bring each characteristic nearer our ideal. Just so with the instructor's study of the characteristics of his apprentices, if honestly made, it will show him not only where the boy needs assistance, but also where he as an instructor has failed and needs to make a greater effort to bring out the best that is in each boy. Personnel officers and other executives will likewise find a searching study of the characteristics of the men in their charge to be of inestimable value.

The study of these characteristics is of far more importance than the terminology of the report or the interpretation of the terms used. Some of the terms used on our card more or less overlap. Some of them may be interpreted differently, but this does not affect the value of the study nor seriously impair the value of the record.

From Observer's letter, he appears to be of the opinion that there are no degrees of honesty, that all men are either honest or dishonest. This opinion is shared by writers of

certain articles recently published in England. Those of this opinion in filling out the card in question would necessarily rate the boy's honesty as either poor or very good. But are there not different degrees of honesty and of morality just as there are different degrees of good and bad? One swallow doesn't make a summer. One good act doesn't make a saint. Neither does one bad act necessarily make a boy a "bad egg." Is a boy who would cheat in a school examination when his fellow students were permitted to do likewise necessarily as dishonest as one who realized the seriousness of his offense and persisted in his dishonest practice? Or is one who, in a moment of weakness, temptation or fear, covers up a job of spoiled work in the shop, say by bending a slightly misfitting bolt to make it appear tight, as dishonest as one who continually deceives his employer as to the quality of his work, or as one who wilfully steals and disposes of company property? Or is a boy who at some time in his life stole a watermelon as dishonest as one who robs a bank? One leading and guiding young men must take many things into consideration and endeavor to see the boy's viewpoint. One apparently dishonest act need not brand the boy as a thief.

As to the term temperance, this need not be restricted to the amount of intoxicating liquors used. The ideal apprentice should be temperate in all things.

It should not be difficult to differentiate between the words initiative and resource. A boy might be resourceful in being capable of finding some other way of accomplishing his task when ordinary methods failed, and yet have very little initiative to start anything or to go ahead for himself. The trait of initiative is rather one of leadership or originality than of resourceful ability.

But let us repeat that the terminology used is not so important as is the study of the apprentice's characteristics. The filling out of some such card at stated periods will aid in making the study more thorough and effective.

Incidentally, these reports have their value as a record. But in justice to the boy, it must be remembered that each report merely represents one man's opinion. Their greatest value as a means of judging one's real character and ability will be found when the reports from the different instructors or foremen are considered together. In passing on the fitness of apprentices the apprentice board as a whole should render judgment. The future of the boy and his value to his employer should not be blighted by the unfair prejudice or erroneous opinion of one member of the board. Every effort should be made to ascertain each boy's fitness, to place him where he belongs, to give him the experience and training needed to develop him to his greatest possibilities. A right study and record of his personal characteristics will be found a means to that end.

Apprentice Instructor.

## Co-operation—The Spirit of Service

Lorain, Ohio.

To the Editor:

Like unto the fabled traveller through the Alpine village, whose cry was "Excelsior," we of the older school of railroad shop mechanics who have kept to our faith that someday, somehow, a brighter day would dawn for us, felt as if our dreams were about to be realized when first the idea of co-operation was spread amongst us. Truly we felt as if the millennium had arrived.

Some one has defined the term co-operation as the spirit of service. If two parties agree to co-operate it becomes imperative that each one bear an equal share of the burden. There must be a closer relationship established, more of the spirit of understanding between them and a readiness to concede that though one must wear the overalls it does not imply a lower moral or mental understanding. Many good shopmen have become discontented and careless in their duties because those in charge did not have brains enough to know that the adoption of an "holier than thou" attitude was the one most calculated to breed discontent and make of themselves a liability to the company rather than an asset. Human nature changes slowly, but there is always hope for the future.

Why should not this idea of co-operation spread? To the thinking worker it means, if carried out in its fullest sense, steady employment, contentment at work and the knowledge of efforts being appreciated. To most shop men, when these three items are assured, nothing more could add to their happiness. To the company it means just one thing—success. What an enviable position the president of a railroad occupies, who has back of him an army of contented and efficient employees, all working toward the one ideal—service to the public! No greater honor could come to any man. Railroad employees, as a rule, are not visionary, not idealists, and yet not over pessimistic, and to the majority this idea of co-operation should appeal as the means to that goal to which all good men aspire—contentment, both now and in the years to come.

Joseph Smith.

## Changing Trailing Truck Springs

Lynchburg, Va.

To the Editor:

I read with considerable interest the article on changing trailing truck springs which appeared on page 433 in the July issue of the *Railway Mechanical Engineer*. We have a method of changing locomotive springs which I think may also interest the readers of your magazine.

The Southern has a class of Mountain type locomotives which have the driving and trailer spring rigging connected by a cross equalizer. When it is necessary to renew a spring on one of these locomotives, it is run on a track in which there are two 36-in. pieces of removable rail. This track is located just outside of the enginehouse convenient to the spring platform. The work is performed as follows:

1—Place the locomotive on the track so that the removable pieces of rail will be between the back drivers and the trailer wheels.

2—Block the equalizers between the intermediate and the back drivers on both sides of the locomotive.

3—Remove the two pieces of rail and let the back drivers drop in the opening.

4—Block between the back driving boxes and the frame on both sides.

5—Move the back drivers ahead upon the rail and allow the trailer wheels to drop in the opening.

6—Both trailer springs may now be renewed if necessary.

7—Remove the blocking and the job is complete.

This job has been performed on the Southern at the Monroe, Va., shops in 27 min. by a machinist and a helper who assisted in lifting the spring in place. The necessity of handling heavy jacks and oak boards is done away with by this method.

W. R. McIvor.

## Who Can Answer This Question?

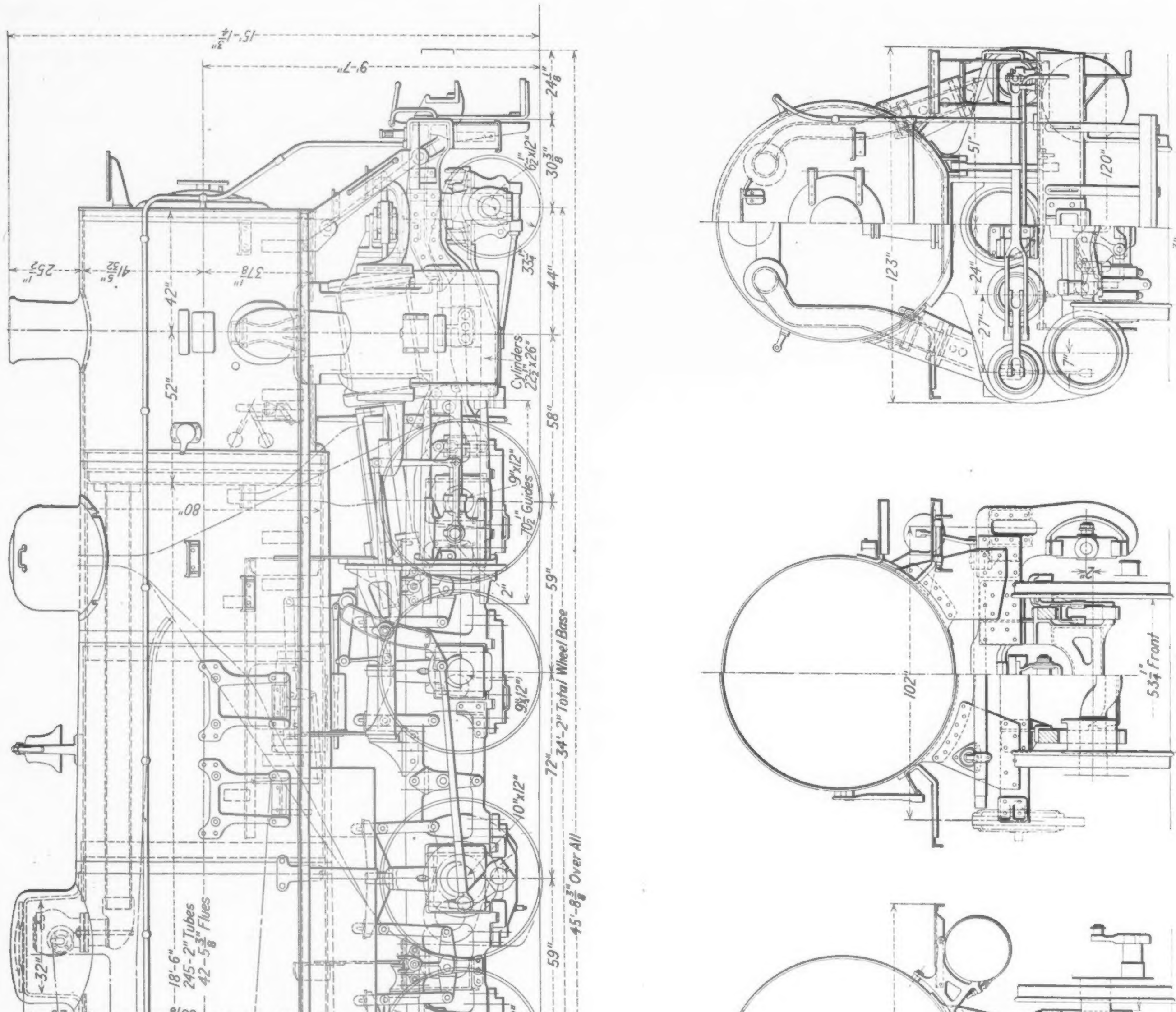
Cordova, Alaska.

To the Editor:

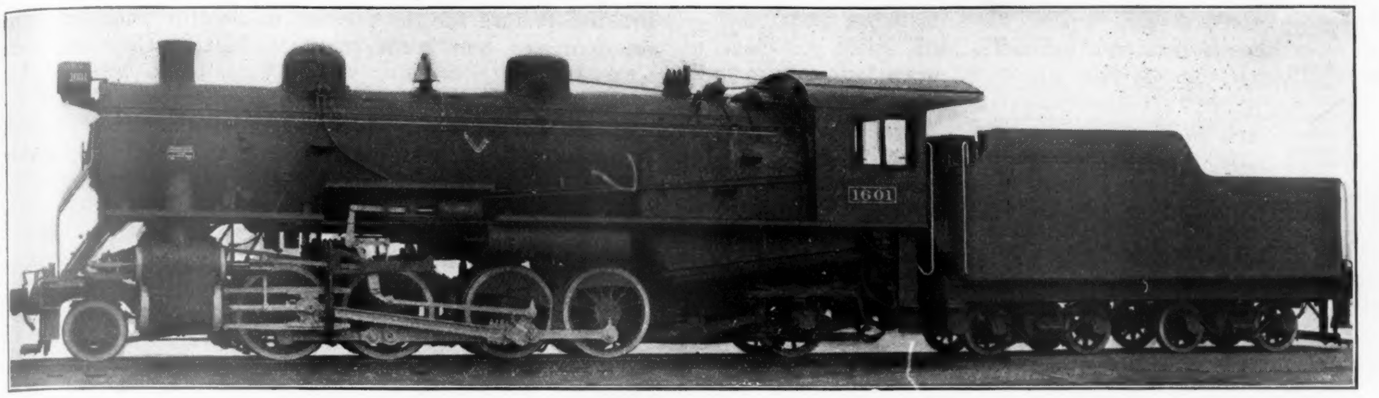
I would like some information relative to the reclamation and recutting of files. It is my understanding that some of the railroads in the United States use an acid solution in which worn files are recut, and that this reclaiming process shows a saving over the cost of new files.

Can you give me this formula and any other information regarding this subject?

James Sheridan,
Copper River & Northwestern.




Elevation and Cross Sections of the South Manchurian Three-Cylinder Mikado Locomotive



*Three-cylinder 2-8-2 type Locomotive built for the South Manchurian Railway.*

# Three-Cylinder Mikado for the South Manchurian

## Unusual Test Methods Provide Accurate Data on the Performance of This Type of Locomotive

THE outstanding development of recent steam locomotive design has been the three-cylinder type. Early in 1923 the American Locomotive Company converted a two-cylinder 4-8-2 type locomotive into a three-cylinder type for the New York Central and later in the same year one of the same general type was built for the Lehigh Valley, both of which were primarily designed for fast freight service. The same builder has recently completed the construction of five three-cylinder Mikado type freight locomotives for service on the South Manchurian Railway. The design is unusual and, because of the fact that more comprehensive test data is available on actual performance than on previous designs, a description of this locomotive and its performance is of exceptional interest.

### Description of the Locomotive

This locomotive has three simple cylinders 22½ in. in diameter by 26 in. stroke. The main rods of all three cylinders are connected to the third pair of driving wheels. The main and side rods, piston rods and crank axles, with the exception of the crank axle disks, are of chrome-vanadium steel, while the crank axle disks are of carbon-vanadium steel. The cylinders are of the piston valve type, having three 12-in. piston valves of 6-in. travel, 1⅛-in. outside lap, no clearance and 3/16-in. lead in full gear, and the distribution of the steam to the two outside cylinders is controlled by Walschaert valve gear. This, by a valve actuating mechanism similar to that used on the Lehigh Valley Mountain type locomotive, controls the movements of the valve admitting steam to the center cylinder. The driving wheels are 54 in. in diameter outside of the tires. The engine truck is of the Player type, while the Cole-Scoville design is used on the trailing truck. The rigid driving wheel base is 15 ft. 10 in. and the total engine wheel base is 34 ft. 2 in. This locomotive is designed for 1½ per cent grades and to negotiate curves of 16 deg. maximum.

The boiler is of the straight top type, designed without combustion chamber. The firebox is of the wide type, measuring 84¼ in. by 114⅛ in. The crown, side and back firebox sheets are ⅜ in. thick, and the tube sheets ½ in. thick. The firebox water spaces at the sides and back are 4½ in. and 5 in. at the front. The depth of the firebox from the center of the lowest tube to the top of the grate is 24½ in. The crown is radially stayed with 13/16-in. staybolts. Alco staybolts are used.

The boiler tubes are 2 in. in diameter, 245 in number. The flues are 42 in number and 5⅜ in. in diameter. The length of the tubes and flues is 18 ft. 6 in. over tube sheets, and the spacing in the tube sheets is ¾ in. One of this order of five locomotives has been equipped with a Superior flue blower. The Franklin grate shaker, the Franklin butterfly firedoor, the Elvin mechanical stoker and the Type A superheater with a heating surface of 945 sq. ft. are standard on the whole order. The total evaporative heating surface of the tubes, flues, firebox and arch tubes is 3,695 sq. ft., making a combined superheating and evaporative heating surface of 4,640 sq. ft. A Chambers throttle is fitted in the dome.

The Westinghouse operating brake is used on engine and tender. Air pressure is supplied by two Westinghouse 9½-in. air pumps and stored in two main reservoirs, one 22½ in. by 84 in. and the other, 22½ in. by 108 in.

The principal dimensions, weights and proportions are shown in Table I.

TABLE I—DIMENSIONS, WEIGHTS AND PROPORTIONS

| | |
|---|---|
| Type of locomotive | 3 cyl.—2-8-2 |
| Track gage | 4 ft., 8½ in. |
| Cylinders, diameter and stroke | 22½ in. by 26 in. |
| Valve gear, type | Walschaert |
| Valves, piston type, size | 12 in. |
| Weights in working order: | |
| On drivers | 194,200 lb. |
| On front truck | 25,000 lb. |
| On trailing truck | 48,800 lb. |
| Total engine | 268.000 lb. |
| Tender | 135,000 lb. |
| Wheel bases: | |
| Driving | 15 ft. 10 in. |
| Total engine | 34 ft. 2 in. |
| Total engine and tender | 62 ft. 7¼ in. |
| Wheels, diameter outside tires: | |
| Driving | 54 in. |
| Front truck | 33¼ in. |
| Trailing truck | 44 in. |
| Journals, diameter and length: | |
| Driving, main | 10 in. by 12 in. |
| Driving others | 9 in. by 12 in. |
| Front truck | 6½ in. by 12 in. |
| Trailing truck | 8 in. by 14 in. |
| Boiler: | |
| Type | straight top |
| Steam pressure | 180 lb. |
| Fuel, kind | bituminous |
| Diameter, first ring, inside | 80 in. |
| Firebox, length and width | 114⅛ by 84¼ in. |
| Tubes, number and diameter | 245, 2 in. |
| Flues, number and diameter | 42, 5⅜ in. |
| Length over tube sheets | 18 ft. 6 in. |
| Grate area | 66.8 sq. ft. |

| | |
|---|---|
| **Heating surfaces:** | |
| Firebox | 217 sq. ft. |
| Arch tubes | 29 sq. ft. |
| Tubes | 2,361 sq. ft. |
| Flues | 1,038 sq. ft. |
| Total evaporative | 3,695 sq. ft. |
| Superheating | 945 sq. ft. |
| Comb. evaporative and superheating | 4,640 sq. ft. |
| **Tender:** | |
| Water capacity | 6,000 gals. |
| Fuel capacity | 12 tons |
| General data estimated: | |
| Rated tractive force, 85 per cent | 56,000 lb. |
| Cylinder horsepower (Cole) | 2,460 |
| Boiler horsepower (Cole) (est.) | 2,200 |
| Speed at 1,000 ft. piston speed | 37 m.p.h. |
| Steam required per hr | 51,168 |
| Boiler evaporative capacity per hr., lb. water | 45,650 |
| Coal required per cyl. hp., total | 8,000 |
| Coal rate per sq. ft. grate per cyl. hp | 120 |
| Weight proportions: | |
| Weight on drivers ÷ total weight engine, per cent | 72.5 |
| Weight on drivers ÷ tractive force | 3.47 |
| Total weight engine ÷ cylinder hp | 109 |
| Total weight engine ÷ boiler hp | 121 |
| Total weight engine ÷ comb. heat. surface | 57.7 |
| **Boiler proportions:** | |
| Boiler hp. ÷ cylinder hp., per cent | 89.4 |
| Comb. heat. surface ÷ cylinder hp | 1.88 |
| Tractive force ÷ comb. heat. surface | 12 |
| Tractive force × dia. drivers ÷ comb. heat. surface | 651 |
| Cylinder hp. ÷ grate area | 36.8 |
| Firebox heat. surface ÷ grate area | 3.2 |
| Firebox heat. surface, per cent of evap. heat. surface | 5.9 |
| Superheat. surface, per cent of evap. heat. surface | 25.6 |

## Tests of the Manchurian Mikado

On account of the unusual design of the three-cylinder locomotive built for the South Manchurian Railway, the American Locomotive Company was particularly interested in securing accurate tests for determining the mechanical efficiency at various speeds, cut-offs and loads.

An arrangement was made to use the test track and

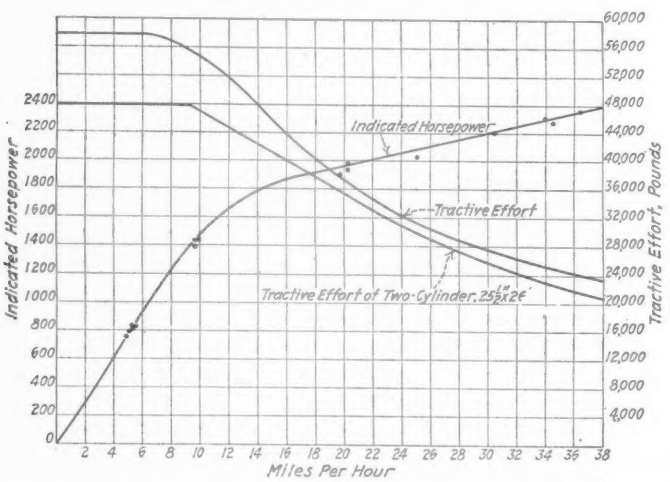



**Fig. 1—Chart Showing Indicated Horsepower and Tractive Force of Three-Cylinder Mikado and Theoretical Tractive Force of Similar Two-Cylinder Locomotive**

facilities of the General Electric Company at the Erie, Pa., works for these tests. The electric locomotive used was one of ten units built for the Mexican Railway Company, Ltd., which at that time happened to be ready for shipment. This locomotive was designed to operate from a 3,000-volt direct current trolley and equipped with the regenerative braking feature for the purpose of holding back trains on the four per cent grades between Mexico City and Vera Cruz.

Because of the well recognized accuracy of electrical instruments, it was possible to determine the draw bar pull being exerted by the steam locomotive much more accurately

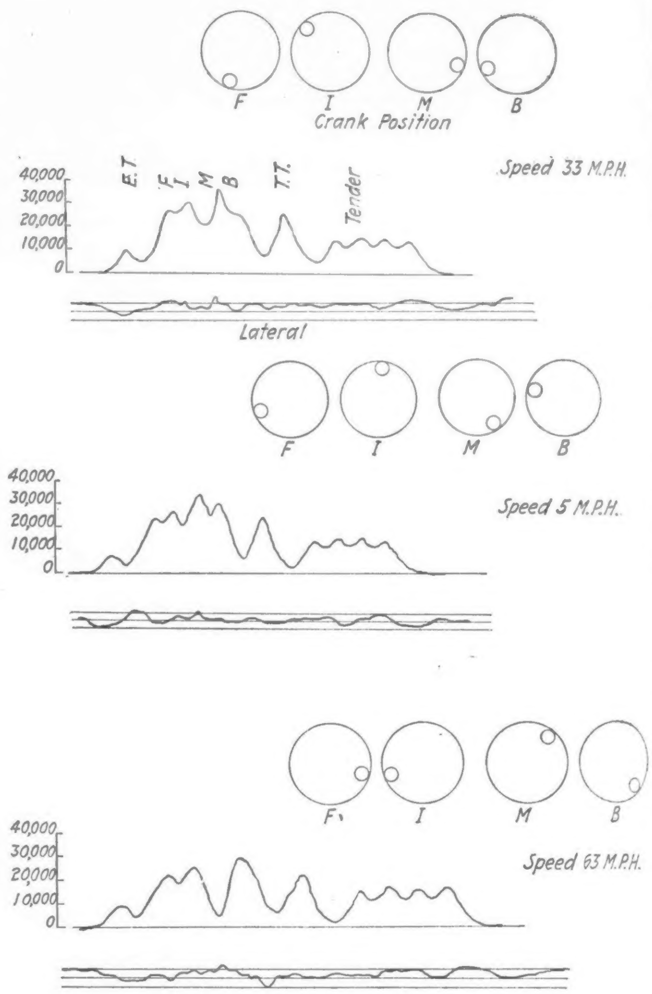



**Fig. 2—Otheograph Records Showing Track Reactions**

than by the use of mechanical measurements. In order to calculate the load for each run, recording and indicating instruments were used reading the total line current, speed and voltages. Speed was indicated on a tachometer in the cab and was also checked by an electrical instrument recording wheel revolutions. From the characteristic curve of the motors it was possible to calculate accurately the electrical losses in the locomotive. The friction losses of the locomotive were obtained by experimental runs. Corrections were also made for grade and curvature.

An interesting check was made on the calculations by using one electric locomotive motoring and the other regener-

TABLE II—SELECTED TEST RECORDS SHOWING DRAW BAR PULL AND MECHANICAL EFFICIENCY

| Speed, m.p.h. | Cut-off, per cent | Boiler pressure | I.hp. | Ind. tractive force | Curve and grade resistance | Draw bar pull from electric loco. | Resistance of engine and tender: Lb. at draw bar | Resistance of engine and tender: Hp. | Mech. efficiency per cent |
|---|---|---|---|---|---|---|---|---|---|
| 5.45 | 83.1 | 180 | 854.8 | 58,800 | 1,050 | 47,684 | 10,066 | 146.3 | 82.9 |
| 10.41 | 79.0 | 180 | 1,540.4 | 55,500 | ..... | 49.319 | 6,180 | 171.6 | 88.9 |
| 14.76 | 49.5 | 180 | 1,583.9 | 40,240 | ..... | 35,219 | 5.020 | 197.6 | 87.5 |
| 15.07 | 72.8 | 173 | 1,364.5 | 33,950 | 1,220 | 30,135 | 2,595 | 104.5 | 92.3 |
| 14.75 | 22.8 | 180 | 898.7 | 22,850 | ..... | 18,319 | 4.530 | 178.2 | 80.1 |
| 25.45 | 72.3 | 181 | 1,773.3 | 26,640 | ..... | 24.319 | 2,320 | 157.5 | 91.3 |
| 30.50 | 58.5 | 177 | 2,200.0 | 27,050 | ..... | 21,619 | 5,430 | 441.6 | 79.9 |
| 34.00 | 49.8 | 178 | 2,264.3 | 24,963 | ..... | 17,599 | 7,364 | 689.0 | 70.4 |
| 34.20 | 45.5 | 179 | 2,177.7 | 23,880 | 1,050 | 17,304 | 5,530 | 504.3 | 76.9 |
| 33.40 | 22.3 | 180 | 1,408.4 | 15,810 | 1,050 | 11,384 | 7,490 | 667.1 | 78.6 |

ating giving in effect a pump-back test in which the sub-station supplied the losses. A number of runs were made at between 5 and 28 m. p. h. By means of voltmeter and ammeter readings, the total output of the locomotive when regenerating was calculated and, making allowance for known losses and compensation for friction and curve losses, the actual drawbar pull was determined.

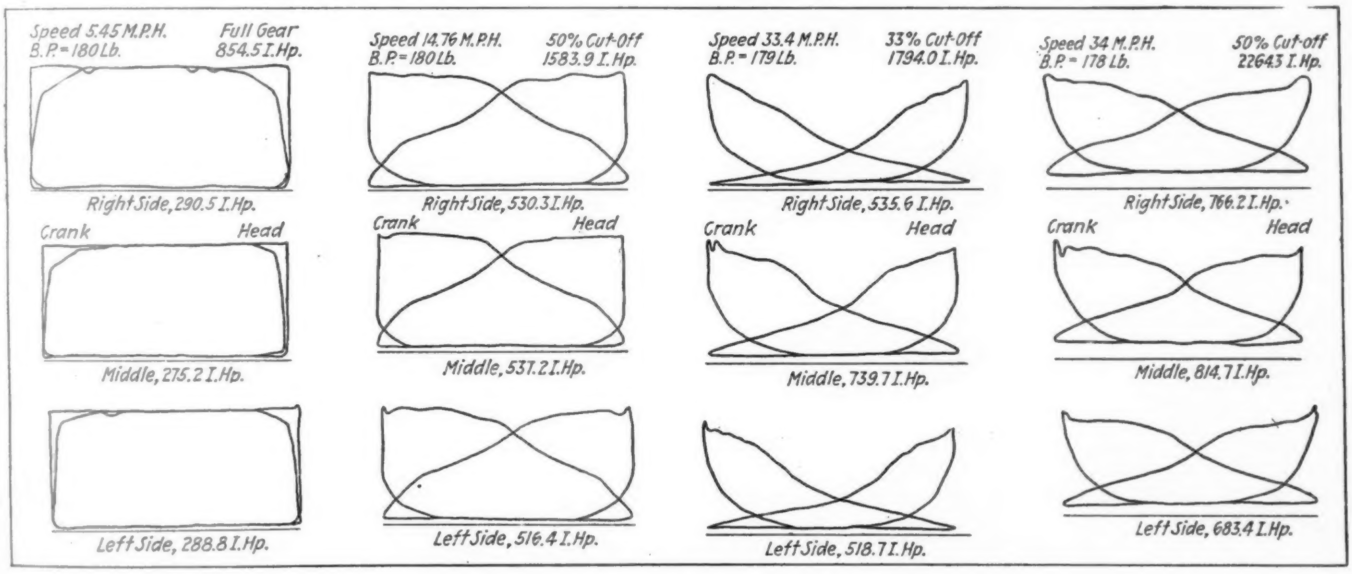
Detailed information showing drawbar pull as obtained from the electric locomotive and the resulting mechanical efficiency of the steam locomotive is given in Table II. The test records given here have been selected from the complete data secured from a total of 65 test runs.

In Fig. 1 have been plotted curves showing the actual tractive force as well as the indicated horsepower, and the third line gives the theoretical tractive force of a similar two-cylinder locomotive having cylinders 25½ in. by 25 in. and a factor of adhesion of four which is considered a normal minimum for two-cylinder locomotives. It is apparent from the curves that the expected capacity of the locomotive was exceeded at the very low, and also at the higher speeds.

Otheograms taken at three different speeds are shown in Fig. 2. Although the locomotive was tested without the customary breaking in, there was no indication of heating at any time, even when the speed was forced up to 63 m.p.h., the equivalent of a piston speed of 1,700 ft. per min. At this speed there was no indication of rough riding in the cab and the records of the otheograph indicate remarkable lateral steadiness, or freedom from nosing, a maximum lateral thrust of 5,000 lb. being observed. The otheograms shown in Fig. 2 illustrate the track reactions at 5 and 33 m.p.h. from which it may be noted that the lateral rail thrust at 33 m.p.h. is 3,000 lb., indicating that the 5,000 lb. obtained at 63 m.p.h. corresponds to great lateral steadiness at this speed.

The rapid acceleration of this locomotive as compared with the two-cylinder type was just as much in evidence as in the previous three-cylinder locomotives built, indicator cards at full piston stroke showing admirable starting conditions.

A slight irregularity in the valve setting appeared in the indicator diagrams, specimens of which are shown in Fig. 3, due to the fact that these cards were taken with the setting just as it was turned out from the shop, there having been no opportunity to make the final adjustments before the tests. Even so the specimen cards show very good equalization of power under the circumstances, and there seems little doubt but that this locomotive is the most remarkable one of its size and general proportions the American Locomotive Company has built both as regards power and flexibility. Primarily designed for freight service, with small wheels 54 in. in diameter and long maximum cut-off, this locomotive is said to have easily attained a speed of 63 m.p.h. with only about a two-mile run to accelerate.




**Characteristic Indicator Cards Taken During Tests**

# Relation of Equipment Design to Maintenance*

By William H. Fowler

**Erecting Foreman, Great Northern, St. Paul, Minn.**

The length of time a locomotive or car is held out of service for repairs is of vital importance and all wide awake superintendents, heads of departments and foremen are on the alert to find how the repairs may be speeded up or the designs changed so as to eliminate the necessity for so many repairs.

It appears that our old friend Co-operation—real co-operation between the various departments, engineering, purchasing and mechanical—can do much.

Often the weaknesses and defects in design, almost invariably showing up when new locomotives are first put into service, could have been eliminated had there been a real get together of mechanics and engineers in looking over the designs before they were finally submitted to the builder.

Recently, a certain railroad, on putting into service a large delivery of passenger and freight locomotives just received, found that there were no shoulders on the valve stem fits. As the engineman tightened the valve rod keys, the valves were thrown out of square so that they had to be taken out, the stem turned down and a collar bushing applied to make a shoulder to hold the valve in place on the stem—a makeshift job at best and yet it cost much in labor and time held from service. Investigation showed that the shoulder had been omitted in the blue print. On some roads the engineering or designing department seems to consider a suggestion from shop men as an interference rather than as a desire

*A paper submitted in the competition on the relation of equipment design to maintenance, which closed February 1, 1924.

to assist the company in its efforts for efficiency. Some shop foremen in Siberia during the war noted that crosshead wrist pins were applied from the outside on locomotives there. Seeing what an immense advantage this would be on heavy American locomotives, they brought the idea home with the result that their company adopted it as standard and caused the change to be made in the design of all its new locomotives. This change saves immeasurable time and labor in putting up and taking down the main rods.

Another road adopted a change which, though simple in itself, saves incalculable delay in tightening nuts on crank pin collar bolts. The change consists in having all crank pin collar bolts with nuts on the outside. When there is not sufficient room for clearance, the pin is counterbored to take the collar and the collar counterbored to take the nut. We all know how difficult it is to tighten the crank pin collar bolt nuts on many locomotives. Although a very important job, it is apt to be slighted when a locomotive must be moved in order to get at the nuts. This slight change obviates all such grief.

Another important item entering into the cost and time required for rebuilding or repairing locomotives and cars is the supply of material kept on hand. This is often inadequate, not because there were not enough supplies purchased, but because they have not been suitable for existing needs. Another place where a bit of co-operation or collaboration of the mechanical and purchasing departments might work wonders.

Often several of a class of locomotives are rebuilt and the various unused parts sent to the stores department to be held for future use. After a few months, a locomotive of this class, not yet rebuilt, is brought in for overhauling and some of the parts require renewing. A call upon the stores department discloses the fact that all these parts have been ordered scrapped. As a result, new ones must be made requiring much time and labor. Were the stores department permitted to hold this second-hand material, a great saving would result.

Another great aid in hastening repairs in shops and roundhouses would be the standardization of locomotive parts much more than is done at present. For instance, the adoption of the best and largest cylinder cock designed for use on all locomotives and of one style of injector instead of a half dozen different ones.

If all possible locomotive parts were made uniform and standard on the entire road, this practice alone would save much delay for material, keeping in service locomotives that would otherwise be waiting for parts, and also decrease the number of parts necessary to be carried in stock.

It is in the actual repairs of a locomotive or car that the errors in design show up most clearly and often the shop foreman or practical mechanic is ready to supply a remedy.

It would create greater interest in the work if his efforts and ideas were recognized by those in authority and if he were occasionally consulted by engineers, draftsmen and officers. A proved practical remedy could then be promptly applied to the defective parts without the long and tedious delays in waiting for authority, which are now necessary.

# Powerful Six-Wheel Switcher for the Monon

## Develops 42,000 lb. Tractive Force with 57-in. Drivers and Has a Total Weight of 191,000 lb.

THERE has been a noticeable decrease in the number of 0-6-0 type locomotives built recently for use on American railways, yet this type presents distinct advantages for handling short run switching and transfer service. It is interesting to note that some recent developments of this type have produced some unusually heavy and powerful units.

Among the heaviest yet built are three 0-6-0 switching locomotives built at the Brooks Works of the American Locomotive Company which were delivered to the Chicago, Indianapolis and Louisville, in October, 1923, and which have been reported as rendering excellent service.

The new locomotives have 23-in. by 28-in. cylinders, develop a tractive force of 42,000 lb. The weight of the engine is 191,000 lb., and of the engine and tender 356,000 lb. The tender has a capacity of 8,500 gallons of water, and 15 tons of coal. The driving wheel base is 11 ft. 6 in., total wheel base of engine and tender, 49 ft. 11¾ in., and the length of the engine and tender over all, 66 ft. 0⅜ in. The diameter of the drivers is 57 in. The boiler is of the straight top type, radial stayed, the first course is 76 in. in outside diameter and the second course 77⅜ in. in outside diameter.


Chicago, Indianapolis and Louisville Switchers Are Among the Heaviest 0-6-0 Type Built

The tubes and flues are of charcoal iron. There are 195 2-in. tubes and 32 5½-in. flues, which are 15 ft. 6 in. long over tube sheets. The pitch of the tubes is 2⅞ in. The center line of the boiler is 9 ft. 2 in. above the rail. With the firebox set back of the drivers, the depth of the throat is 22 5/16 in. from shell of boiler to bottom of mud ring.

The firebox is 73 in. long and 85 in. wide inside the mud ring. The mud ring is of cast steel 3½ in. thick, 4½ in. wide at front and 4 in. wide at sides and back. The grate area is 42.2 sq. ft.

The grates are of the box type and the ash pan of the single hopper type. The hopper frame and door are similar to the U. S. R. A. design. The frames are of cast steel and are in one piece 5 in. wide. The pedestal shoes are of bronze and Franklin wedges are used. The cylinders and valve chambers are bushed with Hunt-Spiller bushings, and this material is used for packing rings, piston heads and cross-head shoes. The tender tank is of the rectangular type with water bottom. The tender frame is of cast steel. Common-wealth trucks are used with Andrews side frames and cast steel bolsters and wheels.

The locomotives were built from designs and specifications furnished by the railway company and contain a large amount of material which is interchangeable with the rail-road company's classes J-1 and K-5-A, Mikado and Pacific types, respectively.

The principal dimensions and data are shown in the following table:

TABLE OF DIMENSIONS, WEIGHTS AND PROPORTIONS

| | |
|---|---|
| Type of locomotive | 0-6-0 |
| Service | Switching |
| Track gage | 4 ft. 8½ in. |
| Cylinders, diameter and stroke | 23 in. by 28 in. |
| Valve gear, type | Walschaert |
| Valves, piston type, size | 12 in. |
| Maximum travel | 6 in. |
| Outside lap | 1 in. |
| Exhaust clearance | 0 in. |
| Lead in full gear | $\frac{1}{16}$ in. |
| **Weights in working order:** | |
| On drivers | 191,000 lb. |
| Total engine | 191,000 lb. |
| Tender | 165,000 lb. |
| **Wheel bases:** | |
| Total engine | 11 ft. 6 in. |
| Total engine and tender | 49 ft. 11¾ in. |
| **Wheels, diameter outside tires:** | |
| Driving | 57 in. |
| **Journals, diameter and length:** | |
| Driving, main | 10 in. by 13 in. |
| Driving, others | 9¼ in. by 13 in. |
| **Boiler:** | |
| Type | Straight top |
| Steam pressure | 190 lb. |
| Fuel, kind | Bituminous |
| Diameter, first ring, inside | 74$\frac{11}{16}$ in. |
| Firebox, length and width | 72⅛ in. by 84¾ in. |
| Arch tubes, number | 4 |
| Flues, number and diameter | 195—2 in. |
| Flues, number and liameter | 32—5½ in. |
| Length over tube sheets | 15 ft. 6 in. |
| Grate area | 42.2 sq. ft. |
| **Heating surfaces:** | |
| Firebox | 156 sq. ft. |
| Arch tubes | 20 sq. ft. |
| Tubes | 1,574 sq. ft. |
| Flues | 710 sq. ft. |
| Total evaporative | 2,460 sq. ft. |
| Superheating | 593 sq. ft. |
| Comb. evaporative and superheating | 3,053 sq. ft. |
| **Tender:** | |
| Water capacity | 8,500 gals. |
| Fuel capacity | 15 tons |
| **General data estimated:** | |
| Rated tractive force, 85 per cent | 42,000 lb. |
| Cylinder horsepower (Cole) | 1,809 |
| Steam required per hour | 37,650 lb. |
| **Weight proportions:** | |
| Weight on drivers ÷ tractive force | 4.55 |
| Total weight engine ÷ comb. heat. surface | 62.6 |
| **Boiler proportions:** | |
| Tractive force ÷ comb. heat. surface | 13.7 |
| Tractive force × dia. drivers ÷ comb. heat. surface | 784 |
| Firebox heat. surface ÷ grate area | 4.17 |
| Firebox heat. surface, per cent of evap. heat. surface | 7.16 |
| Superheat. surface, per cent of evap. heat. surface | 24.1 |
| Tube length ÷ inside diameter | 105 |

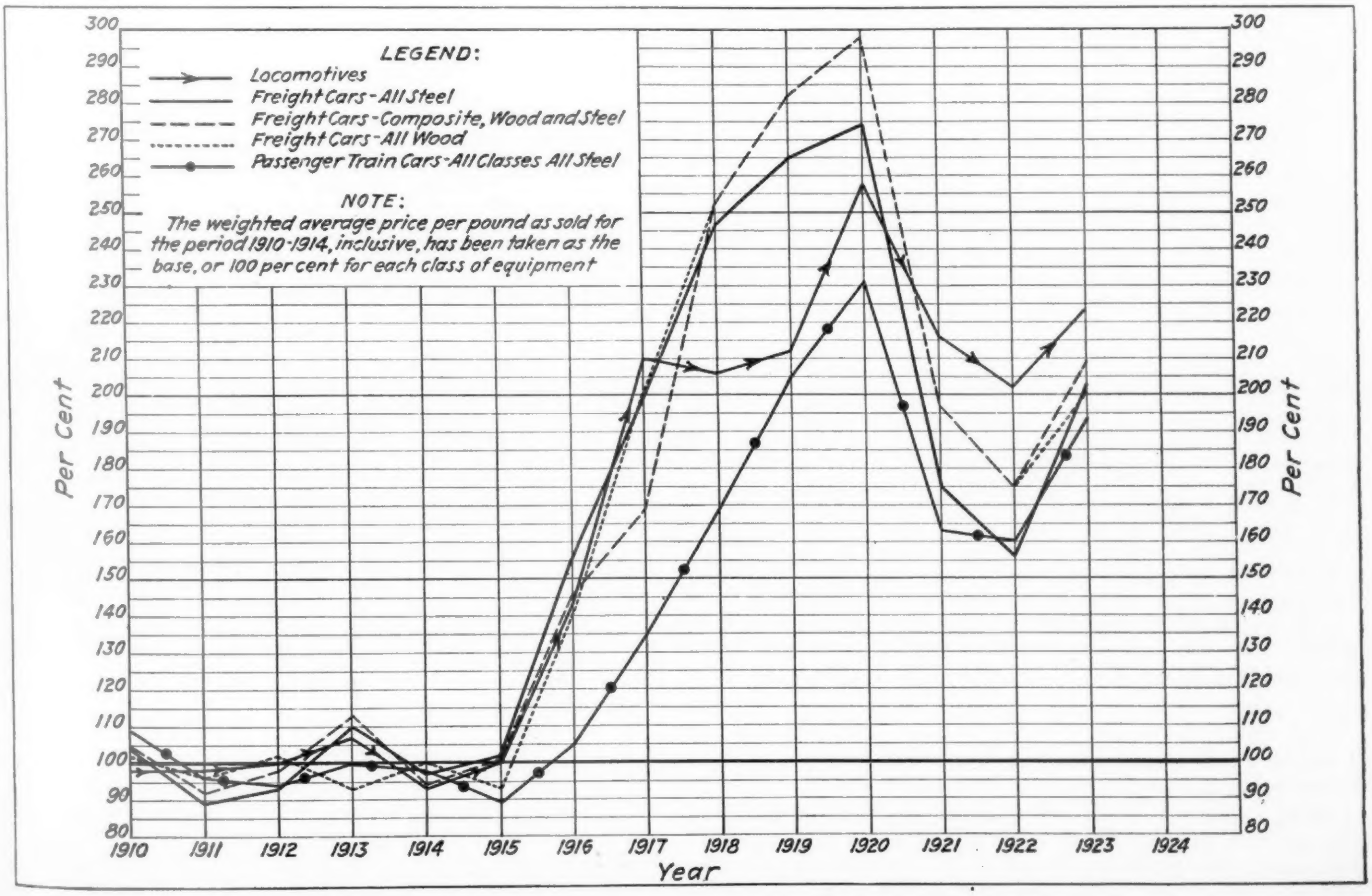
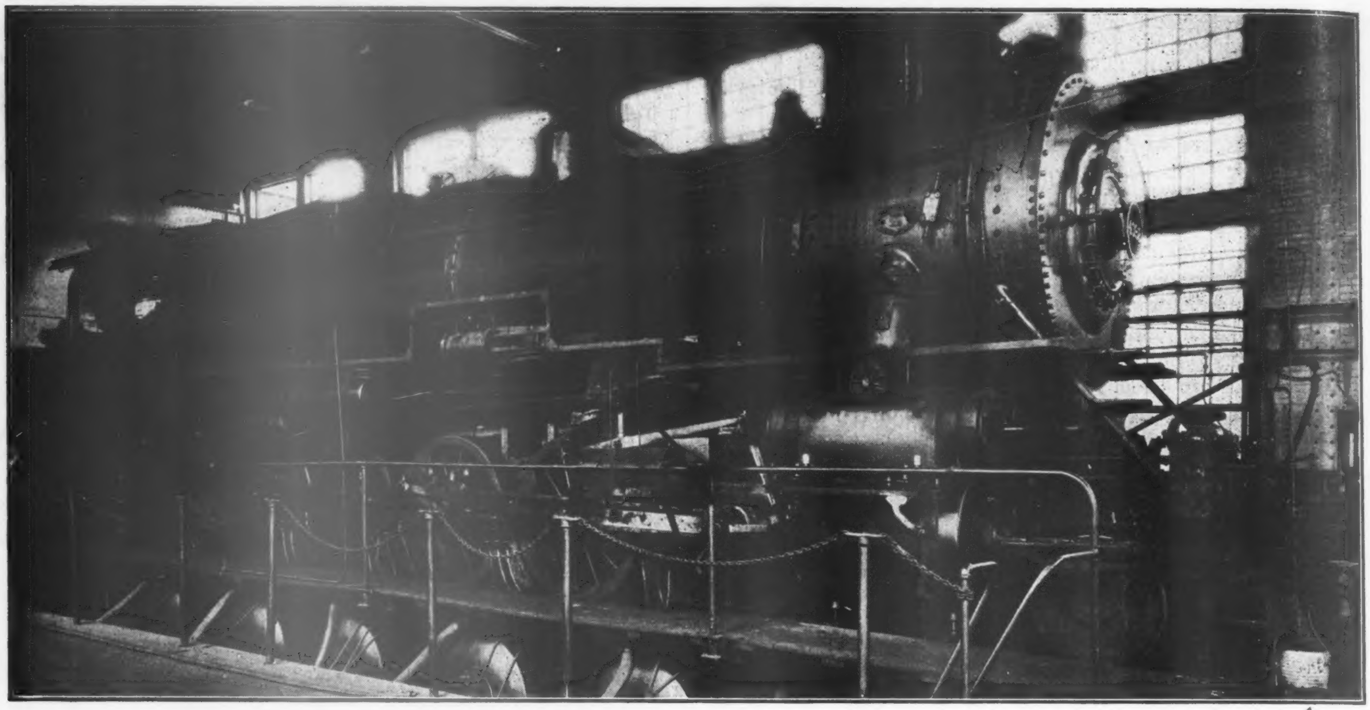



**Chart Showing the Relative Prices of Cars and Locomotives from 1910 to 1923 Inclusive**



*Decapod Type Locomotive No. 4358 on the Testing Plant at Altoona, Pa.*

# Decapod Tests Show Well Defined Fuel Economy

## Addition of Feedwater Heater Results in 14 Per Cent Coal Saving Over Previous I1s Pennsylvania Locomotives

WHEN the first of the Decapod, or 2-10-0 type, locomotives was built by the Pennsylvania, exhaustive tests were conducted at the Altoona test plant to determine the relative efficiency of this type, which has cylinders working at a maximum cut-off of 50 per cent, as compared with the L1s Mikado type freight locomotive with cylinders working at long maximum cut-off. These tests, made on locomotive No. 790 were described in the *Railway Mechanical Engineer* for April, 1920, page 193. Certain alterations in design were made as a result of the test and 122 more locomotives of the same type were built and placed in service.

Since August 1922 the Pennsylvania has received from the Baldwin Locomotive Works 475 additional class I1s locomotives, making a total of 598 now in service. These latest Decapods are of substantially the same design as the previous ones except for the addition of a feedwater heater and the inclusion of a Type E superheater instead of a Type A. A series of tests has recently been made on one of these locomotives and it is interesting to note that the addition of the feedwater heater has resulted in material savings over the previous locomotives not so equipped.

The results of these test plant trials are given in detail in Bulletin No. 32 (copyright 1924 by the Pennsylvania Railroad System) from which the information in this article has been secured.

Locomotive No. 4358, selected for these tests, was built in January, 1923, and had been in service for about one month before being put on the testing plant. The principal dimensions of locomotive No. 4358, used in these tests and of No. 790 used in the tests previously described are shown in the following table together with similar dimensions of the L1s Mikado type freight locomotive used on the Pennsylvania:

General Dimensions of Locomotives of the I1s and L1s Classes

| | | | |
|---|---|---|---|
| Class | I1s | I1s | L1s |
| Type | 2–10–0 | 2–10–0 | 2–8–2 |
| Number | 4358 | 790 | 1752 |
| Year built | 1923 | 1918 | 1914 |
| Weight in working order, lb. | 386,100 | 371,000 | 320,700 |
| Weight on drivers, lb. | 352,500 | 341,000 | 240,200 |
| Weight of engine and tender in working order, lb. | 590,900 | 575,700 | 497,050 |
| Tractive force (calculated) lb. | *90,024 | *90,024 | x61,465 |
| Tractive force per lb. m. e. p. | 480 | 480 | 353 |
| Driving wheels, diameter, in. | 62 | 62 | 62 |
| Wheel base, driving, ft. and in. | 22–8 | 22–8 | 17–½ |
| Wheel base, total, ft. and in. | 32–2 | 32–2 | 36–4½ |
| Wheel base, engine and tender, ft. and in. | 73–½ | 73–½ | 73–3½ |
| Cylinders (simple) diameter and stroke, in. | 30½ x 32 | 30½ x 32 | 27 x 30 |
| Valves (piston) diameter, in. | 12 | 12 | 12 |
| Valve motion, type | Walschaert | Walschaert | Walschaert |
| Boiler pressure, lb. per sq. in. | 250 | 250 | 205 |
| Firebox, type | Belpaire | Belpaire | Belpaire |
| Grate area, sq. ft. | 70 | 70 | 70 |
| Small flues, number | 114 | 244 | 236 |
| Small flues (outside diameter) in. | 2.25 | 2.25 | 2.25 |
| Large flues (for superheater) number | 200 | 48 | 40 |
| Large flues (outside diameter) in. | 3.25 | 5.5 | 5.5 |
| Flues, length, in. | 228 | 228 | 228 |
| Heating surface, flues, sq. ft. (fireside) | 4104 | 3667 | 3373 |
| Heating surface, firebox (fireside) (including arch pipes) sq. ft. | 287 | 287 | 305 |
| Evaporative heating surface (fireside) sq. ft. | 4391 | 3954 | 3678 |
| Superheating surface (fireside) sq. ft. | 2410 | 1460 | 1215 |
| Heating surface, total (fireside) sq. ft. | 6801 | 5414 | 4893 |
| Feedwater heater (open type) | Worthington | None | None |
| Stoker | Duplex | Duplex | None |
| Ratio of weight on drivers to tractive force | 3.9 | 3.8 | 3.9 |
| Total heating surface to grate area | 97.1 | 77.4 | 69.9 |
| Flue surface to fire box surface | 14.3 | 12.8 | 11.1 |
| Superheating surface to evaporative heating surface | 0.55 | 0.37 | 0.33 |

x Based on mean effective pressure, equal to 85 per cent boiler pressure.
* On account of limited cut-off, based on a mean effective pressure equal to 75 per cent of boiler pressure.

The boiler is of the extended wagon top type with Belpaire firebox, wide grate and a combustion chamber three feet long. The working pressure is 250 lb. per sq. in. and to provide for this high pressure the barrel plates have been made 1¼ in. thick. It is equipped with a Duplex stoker,

arranged so that the two elevators deliver their coal at alternate periods.

The boiler is fitted with the Superheater Company's Type E superheater in which there are 100 1-3/16-in., outside diameter, superheater elements, located in 200 3¼-in. boiler flues, each element making a single pass in each of two adjacent flues. There are 114, 2¼-in. flues in which there are no superheater elements. With this superheater the evaporative heating surface has been increased 11 per cent and the superheating surface 65 per cent over that of the earlier I1s boiler, which was fitted with a Type A superheater.

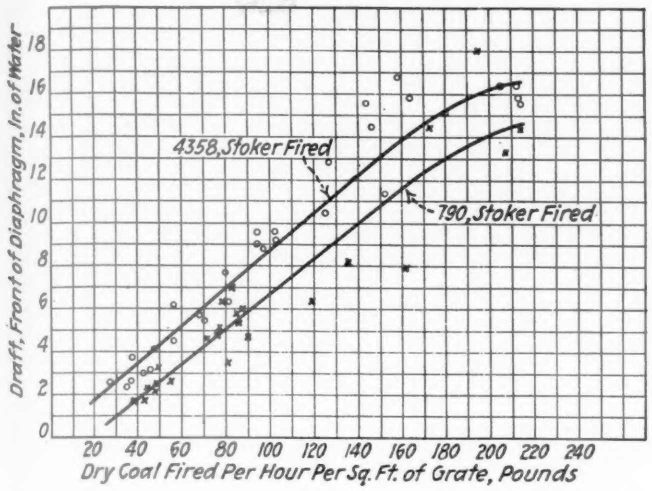



Fig. 1—Comparison of the Draft in Front of the Diaphragm, on Locomotives With and Without Feedwater Heaters

The details of the cylinders, valves and arrangement of steam and auxiliary ports are the same as in the earlier class I1s locomotive which has been described in a previous article. A new type crosshead having a single bar guide with five enclosed bearing surfaces is used on these latest Decapods.

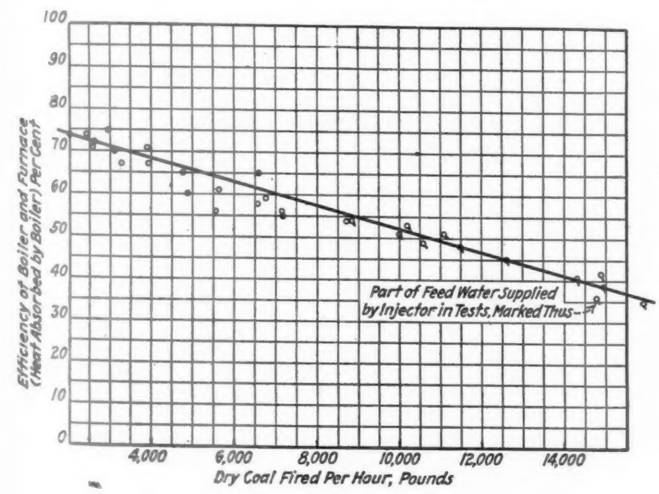



Fig. 2—Efficiency of the Boiler and Furnace

This is the first class of locomotives on the Pennsylvania Railroad on which a feedwater heater is standard equipment. The heater is of the Worthington open type, in which the feed water is heated by mixture with the exhaust steam.

## Coal Used in Tests

All the tests reported here were made with coal of one kind, from a single mine. This was a high volatile bituminous coal from the Crows Nest mine. It was in run of mine size and estimated to contain from 15 to 50 per cent lumps. This is the same kind of coal as used in tests of the earlier class I1s locomotive No. 790. A representative sample from a car used in the tests when analyzed, gave the following:

PROXIMATE ANALYSIS OF CROWS NEST COAL

| | |
|---|---|
| Fixed carbon, per cent | 57.84 |
| Volatile matter, per cent | 31.12 |
| Moisture, per cent | 0.66 |
| Ash, per cent | 10.38 |
| | 100.00 |
| Sulphur, determined separately, per cent | 1.73 |
| Calorific value, dry coal, b.t.u. | 13,658 |

## Boiler Performance

*Draft, Combustion and Temperature.* This locomotive has the same size nozzle as the former I1s No. 790, but the tube arrangement is different and part of the exhaust steam does not pass through the nozzle but goes to the feedwater heater. Fig. 1 shows that, in general, the draft at the front of the diaphragm was higher than in locomotive No. 790.

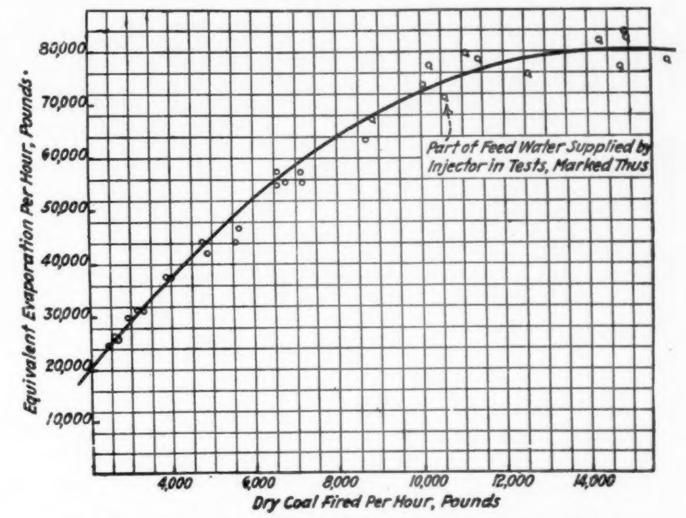



Fig. 3—Rate of Combustion and Equivalent Evaporation

The grate area of this locomotive is 70 sq. ft. Under normal conditions it is fired by a stoker, and the test results show that the maximum rate of firing was above 16,000 lb. per hr., equal to more than 200 lb. per sq. ft. of grate.

The drop in pressure between the boiler and steam chest, due to the friction of the steam passing through the Type E superheater, which has 100 units with a steam passage area of 70 sq. in., is found to be equal on the average to that through the Type A superheater, which has 48 units with an internal area of 54 sq. in.

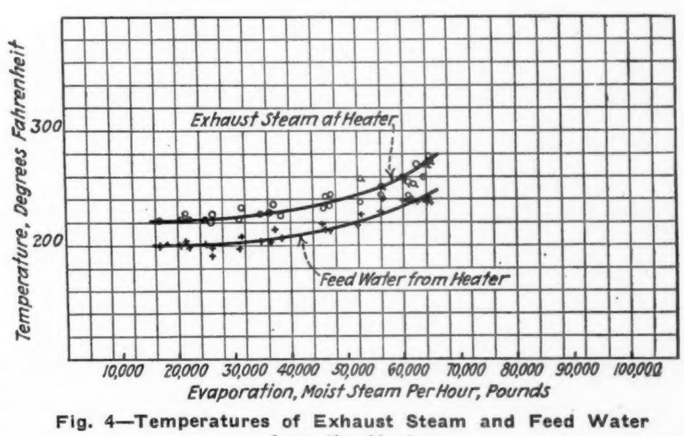



Fig. 4—Temperatures of Exhaust Steam and Feed Water from the Heater

The normal steam temperature due to the boiler pressure of 250 lb. is 406 deg. F., and in the regular tests the steam temperature ranged between 506 and 671 deg. The steam

temperature increased rapidly, with the increase in coal fired, up to a rate of about 160 lb. per sq. ft. of grate per hour, after which a greater rate of firing produced little or no increase in steam temperature. When compared with the earlier class I1s locomotive the superheat temperatures are alike for the two locomotives, when worked at the same rate of combustion.

*Evaporative Capacity.* When the first tests were made the locomotive had an exhaust nozzle 7⅜ in. in diameter with four projections. The net area of the nozzle was 40 sq. in., and with it the maximum equivalent evaporation was found to be 68,813 lb. In view of the evaporation of the earlier

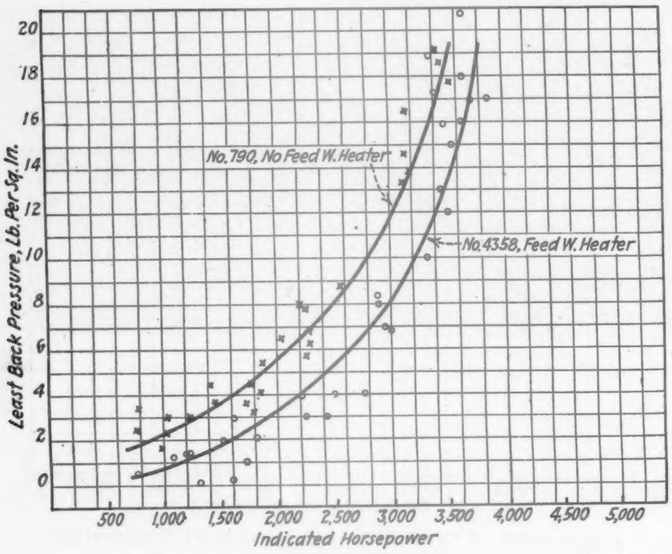



Fig. 5—Comparison of Back Pressures With and Without Feedwater Heater

locomotive of this class, No. 790, this result was thought to be low and the diameter of the exhaust nozzle was changed to 7 in. with four projections, making the net area of the nozzle 35.9 sq. in., equivalent to a 6¾ in. circle. With this 7-in. nozzle, in the only test where the boiler pressure was

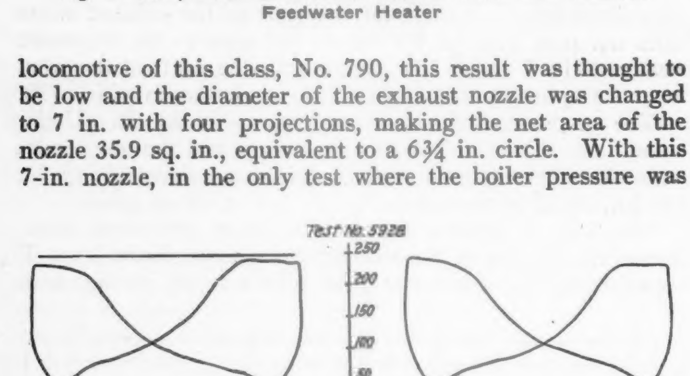



Fig. 6—Characteristic Indicator Diagrams

maintained, the maximum equivalent evaporation was 79,988 lb. per hr.

Locomotive 790 with the same size and type of exhaust nozzle and with a boiler very similar, except for a difference in the superheater and tube arrangement, shows a maximum equivalent evaporation of 82,735 lb. The maximum equivalent evaporation of locomotive 4358 was a little higher than that of locomotive 790, but, considering only the tests at which full steam pressure was maintained, the maximum evaporation of locomotive 790 was higher. The difference between all the maximum figures is only a few per cent and

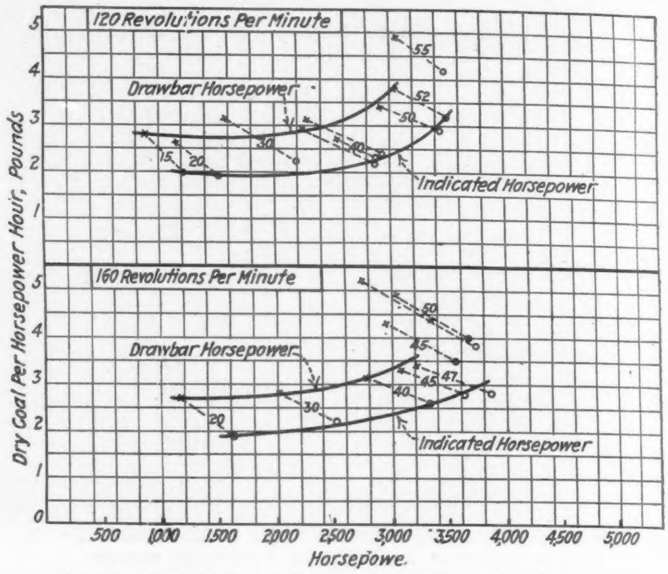



Fig. 7—Coal Rates Per Indicated and Drawbar Horsepower

the capacity of the two boilers, not including the work of the feedwater heater, is approximately the same.

Fig. 2 shows that when locomotive 4358 is stoker fired the efficiency, which is as high as 75 per cent at low rates of evaporation, decreases as the rate of combustion increases until it is only 35 per cent when firing 16,000 lb. of coal per hour. This very low efficiency occurs only when the rate of firing is beyond the reasonable capacity of the boiler. Fig. 3 shows that practically the maximum evaporation of the boiler can be secured by firing 11,070 lb. of dry coal per hour, and when more coal is fired it is largely wasted as it results in only a slight increase in evaporation. It is interesting to note that at this rate of combustion, 159 lb. of dry coal per sq. ft. of grate per hour, the maximum steam temperature was obtained. The equivalent evaporation per pound of dry coal varies from about 10.5 lb. at low rates of

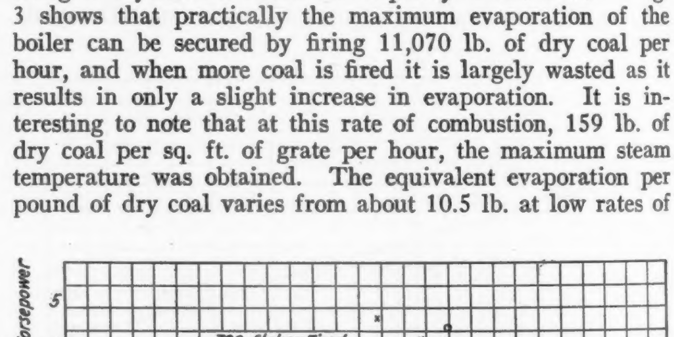



Fig. 8—Comparison of Coal Rates of Locomotives 790 and 4358, Showing Saving Effected by the Latter

evaporation, to between five and six lb. at the maximum capacity of the boiler.

The maximum figure for the equivalent evaporation per hr. per sq. ft. of heating surface reached was 12.3 lb., while the maximum figure for locomotive 790 was 15.3 lb. This difference is explained by the fact that while there is a large increase in the superheating surface of locomotive 4358 there was no corresponding increase in the maximum evaporation.

*Feedwater Heater.* The temperature of the water deliv-

ered by the heater depends upon the temperature of the exhaust steam, and this in general increases with the output of the locomotive. Fig. 4 shows the two temperatures at different rates of evaporation. The highest feedwater temperatures were reached when the locomotive was worked at a rate high enough to require the use of the injector to supplement the feedwater heater. During these tests the temperature and pressure of the exhaust steam were high, but the amount of water delivered by the feedwater heater was limited because part of the boiler feed water was supplied by the injector. The highest feed water temperature in any test where the injector was not used was 218 deg. F.

The direct saving, that is, the proportion of heat saved to the total output of boiler and heater, varied from 7.4 to 10.2

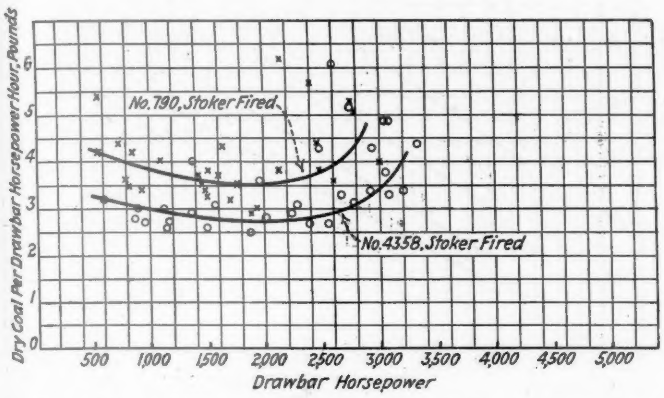



Fig. 9—Comparison of Coal Rates Per Drawbar Horsepower, Locomotives 790 and 4358

per cent in tests in which all the feed water was supplied by the heater. In road service a locomotive is seldom worked at a rate beyond the nominal capacity of the heater, but many of the tests on the plant were beyond this capacity. In these tests there is an increase in the temperature of the water delivered by the heater, but the direct saving due to the heater falls as low as 4.7 per cent because part of the boiler feed water is supplied by the injector.

The heater reduces the amount of water taken from the locomotive tender. The net saving in water by using the heater averages about 10 per cent when the locomotive is worked at rates within the capacity of the heater.

At a given rate of combustion the temperature of the steam from the superheater is not affected by the use of a heater, but as less coal is burned to develop a given indicated horsepower, the temperature of the steam is lower when the heater is used if a comparison is made at equal horsepowers.

In addition to the direct saving of the heater due to recovery of the exhaust steam from the locomotive, there is an indirect saving due to the fact that at a given horsepower the heater reduces the work of the boiler and, therefore, increases the boiler efficiency. In order to determine the total saving due to the use of the feedwater heater, eight tests with the heater, covering a range of evaporation up to its full capacity, were repeated, using the injector only to feed the boiler.

The average coal saving in the eight tests was 13.9 per cent. In the eight tests made with the feedwater heater, the average temperature of the cold feed water was 9½ deg. F. lower than in the tests without the feedwater heater. This lower temperature increased the calculated saving of the feedwater heater but decreased the coal saving, when comparison is made with similar tests with the injector in use.

The heat recovered by the feedwater heater is a direct addition to the heat output of the boiler proper and the maximum steaming capacity of the locomotive is therefore increased in the same proportion. During the tests at or near maximum boiler capacity the heat recovered by the feedwater heater varies from 4.9 to 6.4 per cent of the heat output of the boiler proper, thereby increasing the maximum steaming capacity of the locomotive in the same proportion, an average of 6 per cent. The maximum heat output of the boiler and feedwater heater of locomotive 4358 was 85,580,584 b.t.u. per hr., an increase of 6.3 per cent over the maximum heat output of locomotive 790.

## Engine Performance

The engines of this locomotive are of the limited cut-off type, and with the exception of the crossheads and piston rods, differ in no way from those of the former class I1s locomotive No. 790. The water rate which is 20.8 lb. at 40 r.p.m. and 20 per cent cut-off, has fallen to 15 lb. at 160 r.p.m. and 30 per cent cut-off. At all speeds above 60 and below 180 r.p.m. the water rate lies between 17½ and 15 lb., except in a test at 120 r.p.m. and 55 per cent cut-off, where the steam pressure was not maintained because the maximum capacity of the boiler had been reached. This is a decided improvement over the performance of the L1s locomotive, where in 29 tests the water rate of only one was below 17½ lb. The lowest water rate of the I1s is obtained when the locomotive is developing between 2,100 and 2,500 i.hp. at all speeds except 40 r.p.m., where the maximum horsepower was less than 2,100.

The feedwater heater reduced the temperature of the steam at a given horsepower and should adversely affect the water rate. On the other hand, the feedwater heater, by reducing the amount of steam going through the nozzle, reduces the back pressure and, therefore, decreases the water rate. Fig. 5 shows that the least back pressure of an I1s locomotive equipped with a feedwater heater is considerably lower than that of locomotive 790 without a feedwater heater, both locomotives being equipped with the same size nozzle. These two factors offset each other and the water rate of the two locomotives is found to be in practical agreement.

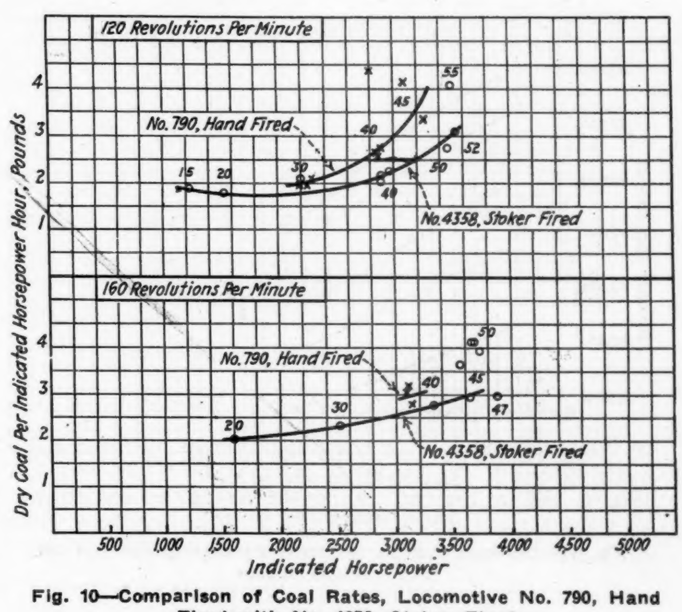



Fig. 10—Comparison of Coal Rates, Locomotive No. 790, Hand Fired with No. 4358, Stoker Fired

Characteristic indicator diagrams are shown in Fig. 6 which are of particular interest in observing that the action of the auxiliary starting ports at full gear does not materially affect the point of cut-off. The action of these auxiliary ports was described at length in a previous article.

## Locomotive Performance

The performance of the locomotive as a whole is gaged by the coal burned and drawbar horsepower developed, but comparisons are also made on the basis of indicated horse-

power. All the coal and water used in the tests is charged against drawbar horsepower, but the amount chargeable to auxiliaries is not included in that charged against indicated horsepower.

At 40 r.p.m. (7.1 m.p.h.) the coal burned per i.hp. is nearly a uniform amount of 2½ lb. at all cut-offs except 55 per cent, and the coal per drawbar horsepower about 3 lb. At speeds of 40 and 80 r.p.m. (7.1 and 14.2 m.p.h.) the coal rate is shown to increase abruptly at cut-offs beyond 50 per cent. At speeds above 40 r.p.m. the coal rate per i.hp. hour is close to 2 lb. at all rates of working up to 2,500 i.hp. Per drawbar horsepower, it is less than 3 lb. Two tests show a coal rate as low as 1.9 lb. per i.hp. hour, and approximately 2½ lb. per drawbar horsepower hour. Fig. 7 shows the coal rates per i.hp. hour at speeds of 120 and 160 r.p.m.

The coal per indicated and drawbar horsepower has been plotted in Figs. 8 and 9 to compare the performance of locomotive 4358 with that of 790 when both were stoker fired. The average improvement of locomotive 4358, equipped with a heater, is found to be more than 14 per cent, which is the total saving that can be credited to the feedwater heater. As there is no difference between the engines of the two locomotives, the additional fuel saving is that due to the better boiler efficiency.

In Fig. 10 the coal burned per i.hp. hour, is shown comparing locomotive 4358, stoker fired, with 790, hand fired, at different speeds. The reason for making this comparison is that a full set of tests was made for locomotive 790 only hand fired and locomotive 4358 only stoker fired. It has not been possible to obtain as good economy with stoker firing as with hand firing and the charts are of interest in showing that, whatever economy has been lost by the introduction of the stoker, has been regained by the use of the feedwater heater.

The maximum indicated horsepower of locomotive 4358

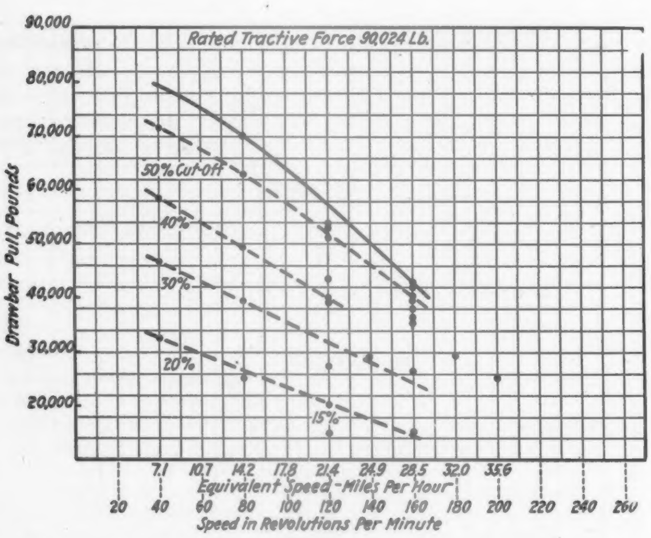



Fig. 11—Drawbar Pull at Different Percentages of Cut-Off and Various Speeds

was 3,863 and was developed at a speed of 160 r.p.m. and 47 per cent cut-off. By dividing the weight of the locomotive in working order, by this horsepower, it is found to weigh 100 lb. per horsepower. The class L1s locomotive weighs 113 lb. per horsepower at maximum rate.

While the average gain in efficiency of locomotive 4358 compared with locomotive 790 is quite large, the maximum increase in horsepower is only 9 per cent. Part of this increase is due to the lower water rate of locomotive 4358 in the particular tests under comparison. An increase in horsepower of 6.4 per cent is due to the increase in steaming capacity resulting from the heat saved by the feedwater heater. When the locomotive is operated at the maximum horsepower the injector is used to supply a large part of the feedwater and, therefore, the increase in power is less than 14 per cent, which is the percentage of saving due to the use of the feedwater heater only when the heater supplies all the feedwater.

In Fig. 11 are plotted some maximum drawbar pulls at different speeds. The amount of steam furnished by the boiler at speeds below about 15 m.p.h., is not the limiting factor in establishing the maximum drawbar pull, as then only a moderate weight of steam is required. The drawbar

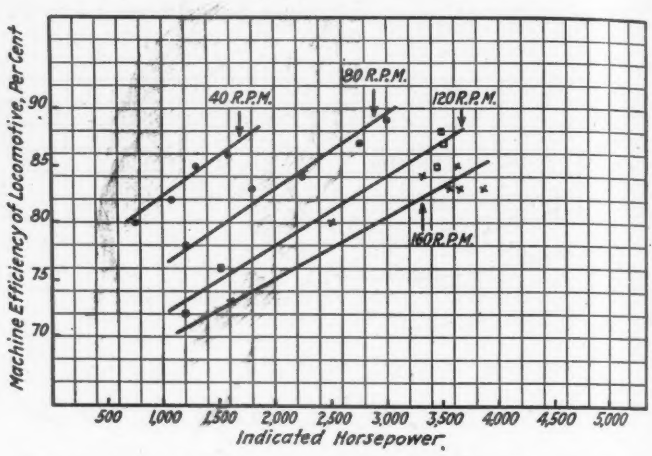



Fig. 12—Machine Efficiency Compared with Speed and Power Developed

pull at these speeds depends upon the dimensions of cylinders and driving wheels for any given boiler pressure.

*Machine Efficiency*—The machine efficiency of locomotive 4358 has a wide range, from 71 to 88 per cent. Over a long series of tests the variation in machine efficiency during duplicate tests is so wide that it is evident that the dynamometer readings are not always correct. In Fig. 12 is plotted the machine efficiency for all tests. The points in Fig. 12 are consistent, and while they may be too high or too low, they show that the machine efficiency follows a regular law decreasing with the speed and, at any given speed, increasing as the power developed is increased.

### Conclusions

In the conclusion of the report on these tests it is stated that "the substitution of the Type E for the Type A superheater with the resultant large increase in heating surface has not noticeably increased the evaporative capacity or efficiency of the boiler; the addition of a feedwater heater has resulted in a coal saving of about 14 per cent. The performance of the engines of this locomotive confirms the results of the tests of the earlier class L1s and show the expected economy when compared with long cut-off engines."

## The Unaflow Locomotive—A Correction

THE September 1924 issue of the *Railway Mechanical Engineer* contained an article by Prof. J. Stumpf describing the unaflow locomotive. Fig. 1 in this article was referred to in the caption as being a theoretical indicator card. The author, however, has kindly brought to our attention that this card is not a theoretical card but is an analysis of an actual indicator card which was taken in tests on the locomotive.

# Bored Pins and Axles for Locomotives

## Increased Strength with Less Weight Can Be Obtained by Using Larger Inside Diameters

### By Lawford H. Fry

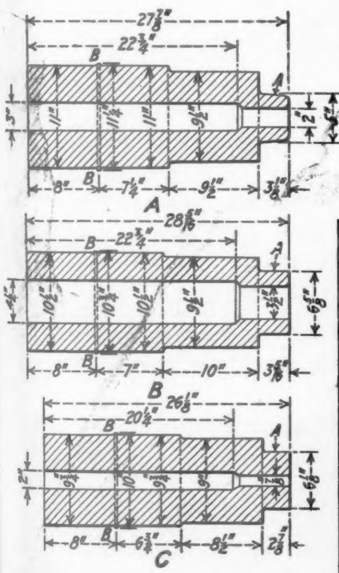
A POINT in locomotive design which has not been given the attention that it deserves is the use of sufficiently large holes in bored axles and crank pins. It is common practice to use an 11-in. axle bored with a 3-in. hole. Such an axle has a section modulus of 130.4 $in.^3$ and a weight of 24.9 lb. per inch of length. Reference to the accompanying tables shows that if the axle is made 11¼ in. in diameter with a 5-in. hole, the section modulus will be 131.8 $in.^3$ while the weight is reduced to 22.6 lb. per linear inch. This reduction of 2.3 lb. per inch represents a nine per cent reduction in weight and, in an axle 69 in. long, amounts to a saving of practically 160 lb. In the case of crank pins a proportionate saving can be made by the use of ample sized boring. The actual saving is not so great owing to the shorter length of the pin, but it must be remembered that every pound of weight saved in the revolving parts enables the same saving to be made in the counterbalance, so that a saving of 100 lb. in crank pin weight means a saving of 200 lb. in the locomotive weight.

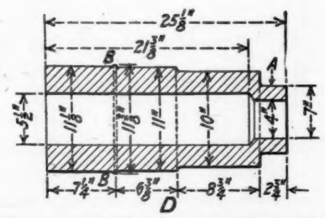
### A Large Bore Has Desirable Features

The use of a large bore, besides being of mechanical advantage in reducing weight, is desirable from a metallurgical standpoint. All locomotive forgings should receive a heat treatment of some sort after being forged and before being placed in service. This heat treatment may be annealing, that is a heating followed by slow cooling; or normalizing, which is a heating followed by cooling in the air; or it may be by quenching and tempering, in which the forging is heated and quenched in oil or water and then reheated to a lower temperature. Whichever treatment is given, the physical properties of the steel will be affected by the thickness of the metal to be influenced and by the amount of surface through which the heating and cooling effects can penetrate the metal. The thinner the wall thickness and the greater the surface, the more effective is the heat treatment and the better the physical properties of the steel. The following table compares the section modulus, weight, wall thickness and surface per pound of metal for three axles, having respectively, no hole, a three-inch hole and a five-inch hole. The length is taken as 69 inches and the outside diameter is assumed to be uniform at 11 inches for the first two and 11¼ inches for the third.

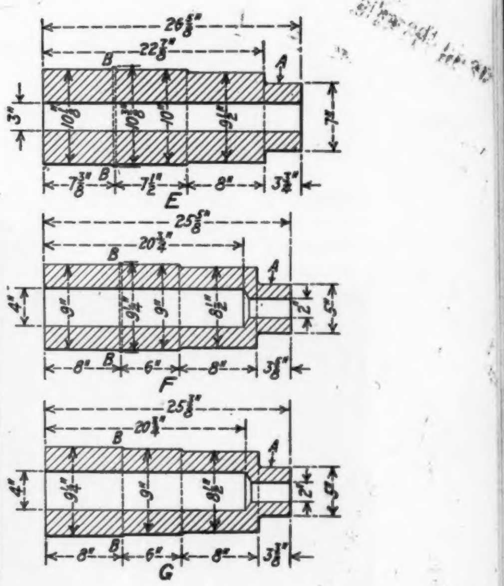
| Outside diam., inches | Bore, inches | Section modulus, $inches^3$ | Total weight, pounds | Wall thickness, inches | Total surface, sq. in. | Surface per lb. of steel, sq. in. | Proportionate increase in surface |
|---|---|---|---|---|---|---|---|
| 11 | Solid | 130.6 | 1,860 | 11 | 2,570 | 1.4 | .. |
| 11 | 3 | 130.4 | 1,720 | 4 | 3,200 | 1.9 | 35 |
| 11-¼ | 5 | 131.8 | 1,550 | 3-⅛ | 3,460 | 2.2 | 57 |

It is evidently more intelligent both mechanically and metallurgically to use an ample bore in the axle.





| Pin | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Material | Carbon Annealed | Carbon Annealed | Carbon Q. & T. | Carbon Q. & T. | Carbon Vanadium | Chrome Vanadium | Chrome Vanadium |
| Min. Tensile Strength of Material Lb./sq. in. | 80,000 | 80,000 | 85,000 | 85,000 | 90,000 | 115,000 | 115,000 |
| Cylinder Diameter | 29¾" | 31" | 29¾" | 30½" | 29½" | 30" | 30" |
| Cylinder Stroke | 32" | 32" | 32" | 32" | 30" | 32" | 32" |
| Boiler Pressure, Lb. per sq. in. | 230 | 200 | 200 | 250 | 200 | 200 | 200 |
| Driving Wheel Diameter | 64" | 63" | 63½" | 62" | 63" | 60" | 60" |
| Weight of Pin, Lb. (Omitting Small End "A") | 554 | 460 | 445 | 420 | 450 | 306 | 315 |
| Area of Piston, Sq. ins. | 695 | 755 | 695 | 731 | 683 | 707 | 707 |
| Piston Thrust (Area x Boiler Pressure) | 159,850 | 151,000 | 139,000 | 182,750 | 136,600 | 141,400 | 141,400 |
| Lever Arm, Inches | 12" | 12" | 11" | 10¾" | 11½" | 10" | 10" |
| Moment (Piston Thrust x Lever Arm) in Lb. | 1,918,000 | 1,812,000 | 1,529,000 | 1,965,000 | 1,571,000 | 1,414,000 | 1,414,000 |
| Section Modulus at "B-B" | 129.5 | 109.6 | 90.7 | 126.9 | 101.2 | 68.7 | 74.9 |
| Max. Fiber Stress at "B-B" ($\frac{Moment}{Modulus}$) | 14,800 | 16,550 | 16,700 | 15,500 | 15,500 | 20,600 | 18,900 |
| Pin Bearing Pressure, Lb. per sq. in. | 1,770 | 1,590 | 1,815 | 2,090 | 1,795 | 2,080 | 2,080 |
| Piston Thrust Per Pound of Pin, Lb. | 290 | 330 | 310 | 435 | 300 | 460 | 450 |



**The Results of Tests on Main Crank Pins of Various Proportions and Materials**

### An Analysis of Seven Main Crank Pins

An analysis of seven main crank pins of the type used on heavy modern locomotives is shown in the drawing which illustrates the effect of design and material. The outside diameters range from 9¼ in. to 11 in., the bores from 2 in. to 5½ in., and the piston thrust at full boiler pressure from 136,600 lb. to 182,750 lb. The materials represented are annealed carbon steel, quenched and tempered carbon steel, normalized carbon-vanadium steel, and quenched and tempered chrome-vanadium steel. It will be seen that the pins are designed for maximum fibre stresses of 15,000 lbs. to 16,000 lbs. per sq. in. for the carbon steel and the carbon-vanadium steels, irrespective of treatment, while for the chrome-vanadium steel fibre stresses of 18,900 lb. and 20,600

| Pin | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Outside diameter, inches.. | 11 | 10½ | 9¼ | 11 | 10 | 9 | 9 |
| Bore diameter, inches..... | 3 | 4½ | 2 | 5½ | 3 | 4 | 4 |
| Piston thrust per lb. of pin weight .............. | 290 | 330 | 310 | 435 | 300 | 460 | 450 |

lb. per sq. in. are allowed. The last line, which shows the pounds of piston thrust carried per pound of metal, is a measure of the efficiency of the design. The figures for bore, diameter and pounds of piston thrust carried per pound of pin weight are repeated in the following table for convenience of reference.

Pins *A*, *C* and *E* with 2 in. and 3 in. bores carry from 290 lb. to 310 lb. of piston thrust for each pound of pin weight. Pin *B* with a 4½ in. bore carries 330 lb., while pin *D* with a 5½ in. bore carries over 40 per cent more with 435 lb. of piston thrust per pound of pin. These five pins are all straight carbon or carbon-vanadium with a maximum fibre stress of about 16,000 lb. per sq. in. The remaining two pins *F* and *G*, which are of quenched and tempered chrome-vanadium steel with an allowable maximum fibre stress of 20,600 lb. and 18,900 lb. per sq. in., carry respectively 460 lb. and 450 lb. of piston thrust per pound of pin. It is to be expected that the chrome-vanadium steel pins with their high tensile strength and consequently high allowable fibre stresses should show the highest load carried per pound of pin weight. At the same time it should be noted that the bore with a diameter of 4 in. stands in a satisfactory relation to the outside diameter which is 9 in. Of the other pins *A*, *C* and *E* are seen to be unnecessarily heavy for the loads they carry. The bores could be made 5 in. instead of 2 in. and 3 in. which would give a saving of about 100 lb. weight for each pin without increasing the fibre stress beyond a safe figure. Pin B with a 4½ in. bore and a diameter of 10½ in. is well proportioned and carries 330 lb. per pound of pin weight. Pin D with a 5½ in. bore stands out above the others with the high figure of 435 lb. of piston thrust per pound of pin weight. This figure approaches those of the highly stressed chrome-vanadium pins, but is obtained with a fibre stress of only 15,500 lb. per square inch. This excellent result can be traced to two causes: first, to the shortness of the pin which gives a lever arm of only 10¾ in. as compared with 12 in. for pin *B;* and second, to the large diameters chosen for the pin body and bore. The second is the more important factor. It is interesting to compare the four pins *B*, *C*, *D* and *E* for modulus and weights, as in the following table.

| Pin | B | C | D | E |
|---|---|---|---|---|
| Outside diameter, in. | 10½ | 9¾ | 11 | 10 |
| Bore diameter, in. | 4½ | 2 | 5½ | 3 |
| Section modulus, in. cu.[3] | 110 | 91 | 122 | 98 |
| Weight per in. of length, lb. | 20.1 | 24.8 | 20.1 | 20.2 |

In pins *B*, *D* and *E* the weight per inch of length is practically the same for all three sections, but compared with pin *E* the better distribution of metal makes the section modulus 10 per cent greater in *B* and 22 per cent greater in *D*. On the other hand pin *C*, because of the small diameter of the body and bore, has nearly 25 per cent greater weight and at the same time about seven per cent lower modulus than even pin *E*.

## Recommended Proportions

It is obvious that the greatest strength with the least weight is obtained by using a large diameter for the body and the maximum practical diameter for the bore. In working in this direction it will be found that a limit is set for the outside diameter by the increase in weight of the surrounding parts, such as rod ends and wrist pin hubs for pins, and journal boxes and axle hubs for axles.

The following proportions between the bore and outside diameter are recommended for pins and axles:

| Outside diameter, inches | Diameter of bore, inches |
|---|---|
| 7 to 8 | 3½ |
| 8 to 9 | 4 |
| 9 to 10 | 4½ |
| 10 to 11 | 5 |
| 11 to 12 | 5½ |
| 12 to 13 | 6 |

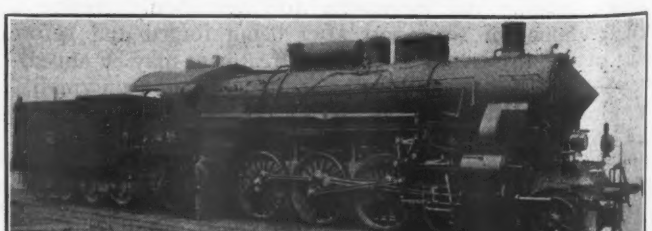
To facilitate study and design Tables I and II are presented. These tables show respectively the values for the section modulus and weight per linear inch for various combinations of outside diameter and bore. In Table I the recommended combinations of bore and body diameter are enclosed in brackets. It will be seen that these combinations provide for a gradual increase in section modulus from 31 in.[3] to 206 in.[3], with the corresponding weights per linear inch increasing from 8 lb. to 31 lb.

Table I

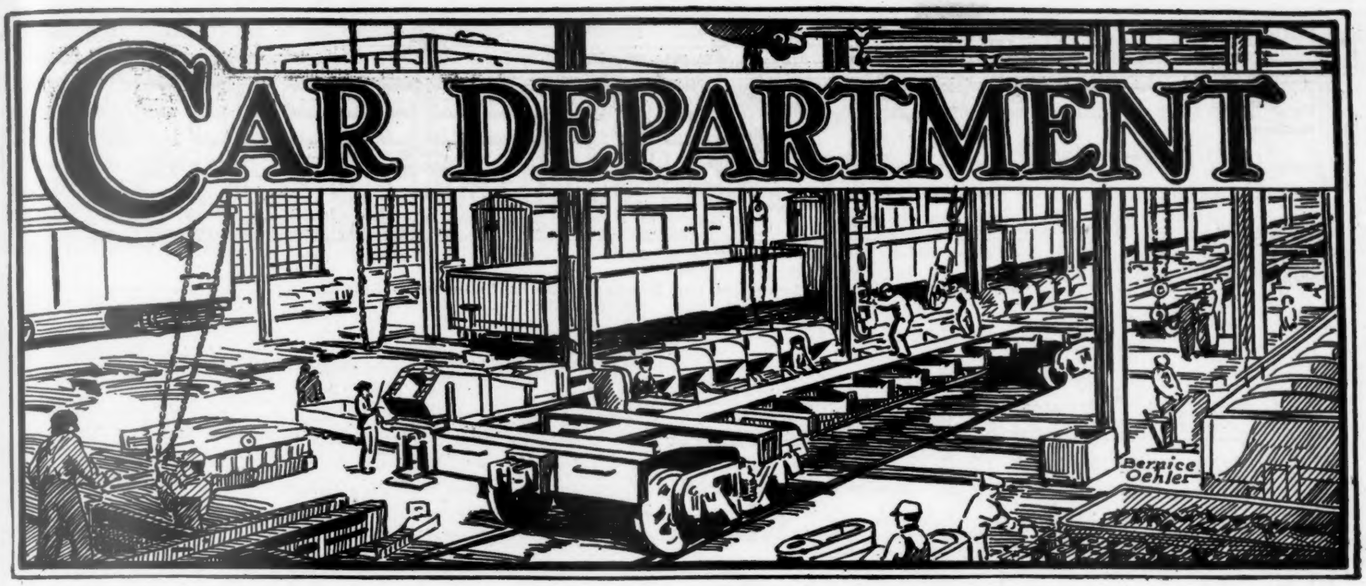
| Outside diameter, in. | Section modulus Diameter of bore: Solid | 3 in. | 3½ in. | 4 in. | 4½ in. | 5 in. | 5½ in. | 6 in. |
|---|---|---|---|---|---|---|---|---|
| 7 | 33.7 | 33.3 | [31.6] | 30.1 | .... | .... | .... | .... |
| ¼ | 37.5 | 37.1 | [35.4] | 34.0 | .... | .... | .... | .... |
| ½ | 41.5 | 41.1 | [39.5] | 38.2 | .... | .... | .... | .... |
| ¾ | 45.7 | 45.3 | [43.8] | 42.5 | .... | .... | .... | .... |
| 8 | 50.1 | 49.8 | [48.3] | [47.0] | 45.1 | .... | .... | .... |
| ¼ | 55.1 | .... | 53.3 | [52.1] | 50.2 | .... | .... | .... |
| ½ | 59.3 | .... | 57.6 | [56.3] | 54.5 | .... | .... | .... |
| ¾ | 65.8 | .... | 64.1 | [62.9] | 61.2 | .... | .... | .... |
| 9 | 71.7 | .... | 70.1 | [68.9] | [67.2] | 62.0 | .... | .... |
| ¼ | 77.7 | .... | .... | 75.0 | [73.3] | 71.0 | .... | .... |
| ½ | 84.1 | .... | .... | 81.4 | [79.8] | 77.6 | .... | .... |
| ¾ | 91.0 | .... | .... | 88.4 | [86.9] | 84.6 | .... | .... |
| 10 | 98.2 | .... | .... | 95.7 | [94.2] | [92.0] | 89.2 | .... |
| ¼ | 105.8 | .... | .... | .... | 101.8 | [99.7] | 97.0 | .... |
| ½ | 113.5 | .... | .... | .... | 109.7 | [107.5] | 104.9 | .... |
| ¾ | 122.0 | .... | .... | .... | 118.2 | [116.2] | 113.6 | .... |
| 11 | 130.6 | .... | .... | .... | 126.9 | [124.9] | [122.4] | 119.1 |
| ¼ | 139.8 | .... | .... | .... | .... | 134.3 | [131.8] | 128.5 |
| ½ | 149.0 | .... | .... | .... | .... | 144.6 | [141.2] | 138.0 |
| ¾ | 159.3 | .... | .... | .... | .... | 154.0 | [151.6] | 148.5 |
| 12 | 169.7 | .... | .... | .... | .... | 162.2 | [159.1] | [155.1] |
| ¼ | 180.5 | .... | .... | .... | .... | .... | 173.1 | [170.1] |
| ½ | 191.8 | .... | .... | .... | .... | .... | 184.6 | [181.6] |
| ¾ | 203.5 | .... | .... | .... | .... | .... | 196.4 | [193.5] |
| 13 | 215.7 | .... | .... | .... | .... | .... | 208.8 | [205.9] |

Table II

| Outside diameter, in. | Weight in lb. per linear inch Diameter of bore: Solid | 3 in. | 3½ in. | 4 in. | 4½ in. | 5 in. | 5½ in. | 6 in. |
|---|---|---|---|---|---|---|---|---|
| 7 | 10.9 | 8.9 | 8.2 | 7.3 | .... | .... | .... | .... |
| ¼ | 11.6 | 9.6 | 8.9 | 8.0 | .... | .... | .... | .... |
| ½ | 12.5 | 10.5 | 9.8 | 8.9 | .... | .... | .... | .... |
| ¾ | 13.3 | 11.3 | 10.6 | 9.7 | .... | .... | .... | .... |
| 8 | 14.2 | 12.2 | 11.5 | 10.6 | 9.7 | .... | .... | .... |
| ¼ | 15.1 | .... | 12.4 | 11.5 | 10.6 | .... | .... | .... |
| ½ | 16.1 | .... | 13.4 | 12.5 | 11.6 | .... | .... | .... |
| ¾ | 17.0 | .... | 14.3 | 13.4 | 12.5 | .... | .... | .... |
| 9 | 18.0 | .... | 15.3 | 14.4 | 13.5 | 12.5 | .... | .... |
| ¼ | 19.0 | .... | .... | 15.4 | 14.5 | 13.5 | .... | .... |
| ½ | 20.1 | .... | .... | 16.5 | 15.6 | 14.6 | .... | .... |
| ¾ | 21.1 | .... | .... | 17.5 | 16.6 | 15.6 | .... | .... |
| 10 | 22.2 | .... | .... | 18.6 | 17.7 | 16.7 | 15.4 | .... |
| ¼ | 23.3 | .... | .... | .... | 18.8 | 17.8 | 16.5 | .... |
| ½ | 24.6 | .... | .... | .... | 20.1 | 19.1 | 17.8 | .... |
| ¾ | 25.7 | .... | .... | .... | 21.2 | 20.2 | 18.9 | .... |
| 11 | 26.9 | .... | .... | .... | 22.4 | 21.4 | 20.1 | 18.8 |
| ¼ | 28.1 | .... | .... | .... | .... | 22.6 | 21.3 | 20.0 |
| ½ | 29.4 | .... | .... | .... | .... | 23.9 | 22.6 | 21.3 |
| ¾ | 30.6 | .... | .... | .... | .... | 25.1 | 23.8 | 22.5 |
| 12 | 32.0 | .... | .... | .... | .... | 26.5 | 25.2 | 23.9 |
| ¼ | 33.3 | .... | .... | .... | .... | .... | 26.5 | 25.2 |
| ½ | 34.5 | .... | .... | .... | .... | .... | 27.7 | 26.4 |
| ¾ | 36.0 | .... | .... | .... | .... | .... | 29.2 | 27.9 |
| 13 | 37.5 | .... | .... | .... | .... | .... | 30.7 | 29.4 |



Pacific Type, 4-cylinder Compound Express Locomotive Used on the Hungarian State Railway




# Chicago & Alton Re-equips Limited Train

## Non-Reversible Seats in the Coaches; Unusual Arrangement of the Observation-Parlor Cars

THE Chicago & Alton has re-equipped its Alton Limited running between Chicago and St. Louis, Mo. The service now consists of two new trains of all steel equipment which were recently received from the Pullman Car & Manufacturing Company, Chicago. They represent an investment of approximately one million dollars and are completely modern in safety devices, lighting, ventilating and heating equipment. All of the cars are fitted with vapor car heating equipment and thermostatic temperature control.

Interior View of the Dining Car, Showing the Buffet and Lower Deck Lights

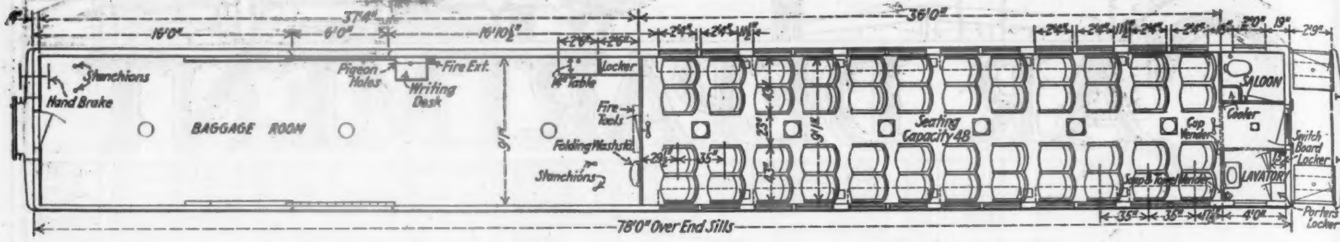
The passenger coaches are unusually long. The coaches, dining cars and parlor cars are 87 ft. in length; the observation-parlor cars are 90 ft. long.

Each of the two trains has a mail storage car, one of which is named for Rudolph Brauer, superintendent of the sixth division, Railway Mail Service and the other for Captain West, chief clerk at large, Railway Mail Service. The railway post office cars are named for Paul Henderson, second assistant postmaster general and for Col. G. B. Armstrong, who is known as the father of the railway mail service.

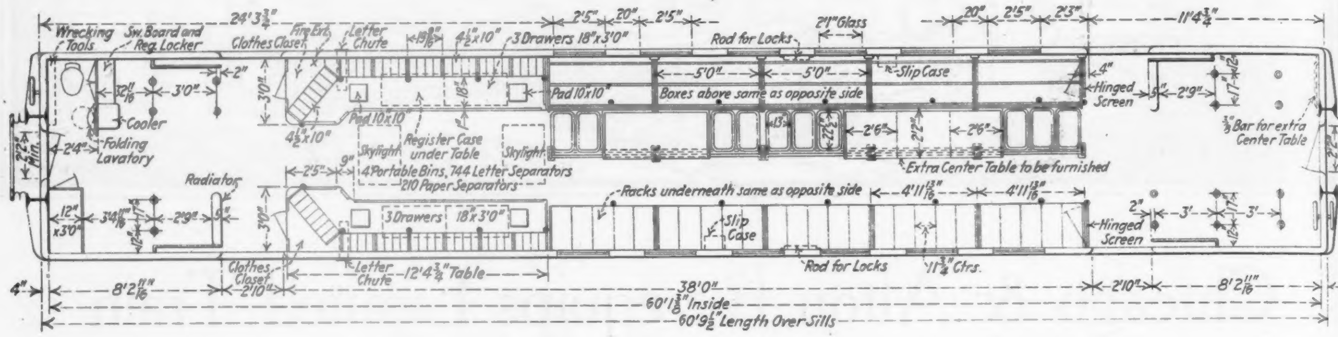
The combination passenger and baggage cars are named for the states of Illinois and Missouri. The length of these cars over the end sills and over the buffers is 78 ft. and 86

The Observation Parlor Car Has Japanese Maid Service

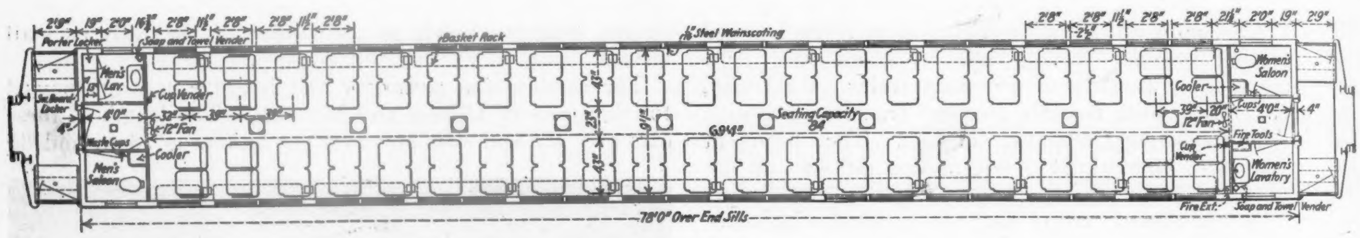
ft., respectively, and the inside length of the baggage compartment is 37 ft. This compartment is provided with a conductor's desk, lockers, baggage writing desk and a folding wash stand equipped with a mirror. The passenger compartment which is used as a smoker, seats 48. The seat design, which is similar to that used in the chair cars, is



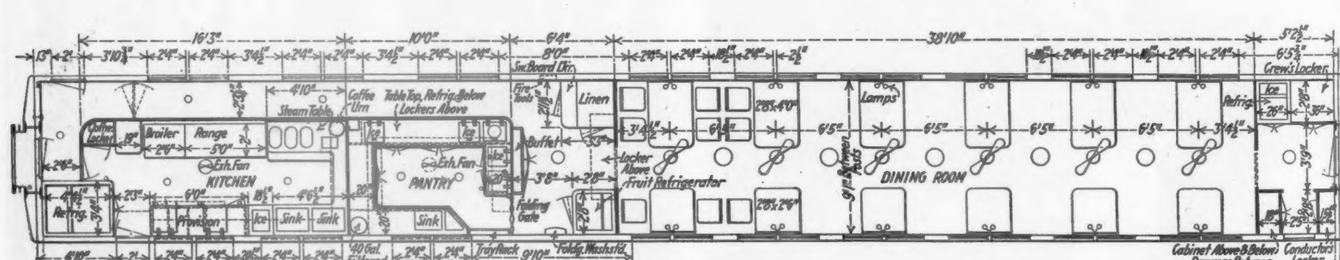

The Passenger Compartment of the Baggage Car Is Used As a Smoker



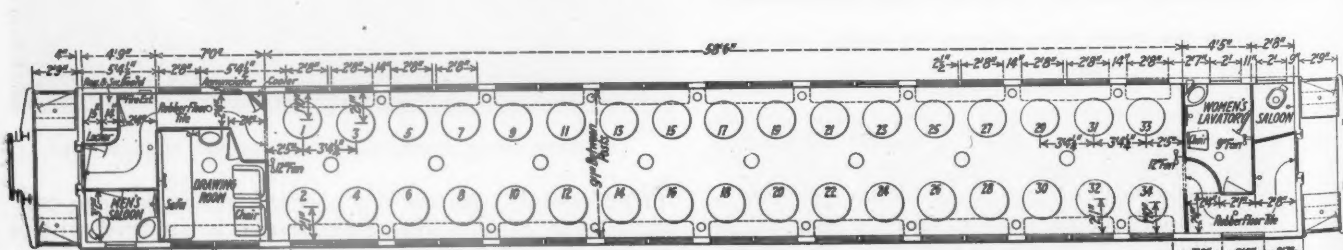

Floor Plan of the Mail Cars




The Chair Cars Have Individual Seats for 84 Persons

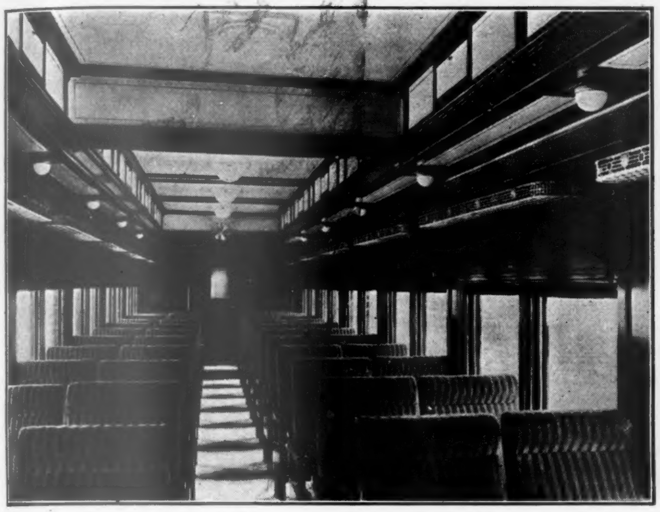



Floor Plan of the Dining Cars




The Parlor Cars Have a Total Seating Capacity of 39 Persons

quite unique. The frame is all metal with the exception of a wooden arm rest. The seats are divided, as shown in the illustrations, and are equipped with detachable seat cushions and backs, which are covered with leather. The interior is similar in general appearance to the parlor and chair cars which are wood, finished in vermilion. The wood finish is applied from the window sills up, including the lower and side decks which tends to give the cars a much more home-like appearance than if a steel interior finish had been used.



The Chair Cars Have Wide Upper Decks and Non-Reversible Seats

A separate saloon and wash room is located at the end of each car.

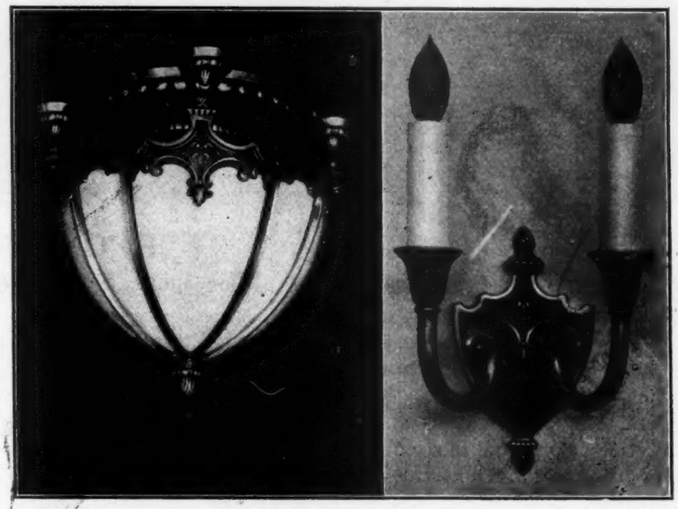
Two chair cars are used in each train, named for Oak Park and Evanston, suburbs of Chicago, and for Webster Grove and University City, suburbs of St. Louis. The over-all length of these cars is the same as that of the combination baggage and passenger cars. The seating equipment is the same as that used in the smoking compartment of the combination passenger and baggage cars, except that the seats are equipped with higher backs and are upholstered with green mohair. These seats, which were furnished by the car builders, are stationary and cannot be reversed, as the entire train is turned at each end of the road. As shown in the illustration, the center ceiling lights and the lower deck lights are placed on each side of the car. The upper deck is unusually wide, measuring approximately seven feet, which gives the car a roomy appearance. These cars are also equipped with separate saloons and lavatories, the men's being located at the front end of the car and the women's at the rear. The aisle strips harmonize with the upholstering and window shades.

The parlor cars are named the George Washington, Thomas Jefferson, Abraham Lincoln, Grover Cleveland, Theodore Roosevelt and Woodrow Wilson. Three of these cars are used in each train. They are the same length as the combination passenger and baggage cars, and chair cars. Thirty-four revolving chairs are provided in each car. These are upholstered in mouse colored plush, striped with braided black. The draperies and carpets harmonize in color with the upholstery. The light fixtures are of statuary bronze and are arranged in a manner similar to that used in the chair cars.

A standard Pullman drawing room, seating five persons, is located at one end of each car, with a women's lavatory and saloon in the other end. The men's toilet is located in the same end as the drawing room. These cars have a total seating capacity of 39 persons each, which is exceptionally large for a parlor car.

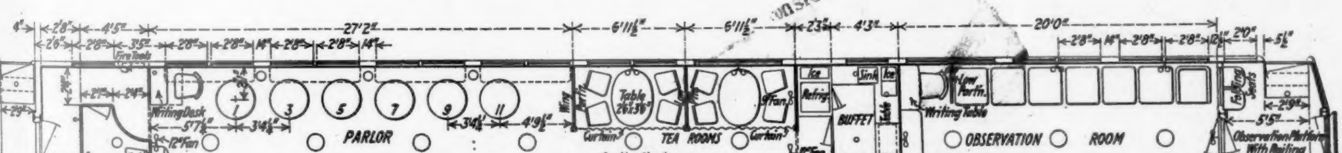
## The Dining Cars

Each of the two trains has one dining car. These cars are named for Springfield, the capital of Illinois and for Bloomington, where the Chicago and Alton railroad shops are located. They have the same vermilion interior finish throughout, including the wooden passageway at the kitchen end of the car. There are ample lockers and refrigerators. Each car has a total seating capacity of 36. The interiors are lighted with numerous candelabras and deck chandeliers of silver.



Ceiling and Side Lights for the Dining and Observation Cars

The kitchen and pantry are finished in white enamel. The equipment includes apparatus for the steam cleansing, sterilizing and drying of china, glass and other table utensils. The kitchen is equipped with an electric exhaust fan and reversible ventilators. All of the silverware and dishes are of special design. At the end of the dining compartment is the conductor's desk with a cabinet above and drawers below. Immediately back of this desk is a conductor's locker and opposite is the crew's locker, together with a refrigerator equipped with a cigar humidor.




Floor Plan of the Observation-Parlor Car

## The Observation-Parlor Cars

The observation-parlor cars are of the most unique in design of any of the cars in the train. In the observation end is

a magazine table and writing desk with telephone service for use at Chicago and St. Louis, and 12 chairs. Immediately forward of this is a buffet, which serves a Japanese tea room and ladies' smoking room. Two enclosures comprise the tea room and along the side of the car opposite to these enclosures are two over-stuffed half-moon sofas provided with smoking stands. Draperies are hung at each end of the sofas, with a low partition between the two tea room enclosures and high partitions at the ends. In front of the tea rooms are 12 parlor car chairs which are for the exclusive use of ladies. A bookcase of special design, containing copies of the latest books, is located in the front end of the car, immediately opposite the writing desk. At the head end of this car is also a women's lavatory and saloon. No provision has been made for a men's lavatory or saloon in this car.

The upholstery in the ladies' parlor and tea room end of the car is of Venetian blue velvet. The upholstery at the observation end is of green velvet with carpet to match. The lighting fixtures in the entire car are similar in design to those in the dining car. Four folding seats, which close automatically as soon as the occupants arise, are provided for the observation platform. There is also ample room for the additional use of from four to six large camp stools with backs, which are carried as part of the equipment of these cars.

The exterior of the cars is finished in maroon with light Venetian tints striped with gold. With the exception of the postal, dining cars and the combined passenger and baggage cars, which are built with blind ends, all of the cars have wide vestibules. Pullman cast steel trucks are used throughout both trains. Each car is also provided with a Giessel water cooler, equipped with a filter.

Both of these trains were run intact from Chicago to St. Louis on September 14, where they were placed on exhibition the first two days of the following week. Both trains were placed in service September 28, one starting from St. Louis and the other from Chicago.

# Economy in Painting Steel Passenger Cars

## Twelve Years' Experience on Soo Line Demonstrates Practicability and Economy of Four Coat System

By G. H. Hammond,
Foreman Painter, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.

IN 1920 at Boston, the writer was privileged to read a paper on the economical painting of steel passenger car bodies, at the convention of the Equipment Painting Section of the American Railway Association, describing in detail how the Soo Line has cut out all needless material and labor used in painting, and at the same time secured greater durability. The paper was not prepared or published until after eight years of thorough test and practical use. At the present time, this system has been the standard practice on the Soo Line for more than 12 years, and not one of these cars has been re-sand blasted, and there is no indication that they will be for years to come.

Within the past four years, some of the other railroads, and at least one car company, have given this system (or as near it as possible) a try out with gratifying results, and are now strong advocates of the abbreviated paint treatment on steel passenger cars.

To all who are interested, the following will show in detail the system as practiced by the Soo Line:

The car is sand blasted to remove all old paint, rust and scale. This is followed by applying one coat of color paint on which the lettering is done, and is then varnished with three coats of outside body varnish.

The Tuscan red body color is in paste form, ground in equal parts of raw linseed oil and gold size japan. This paste color is thinned with raw linseed oil, and nothing else, to a consistency that will cover sand blasted steel with one coat. The color is applied with a bristle brush and smoothed with a hair brush.

The following day the car is lettered. First, pounce with whiting where the lettering is to be applied, and wash off with water after the lettering is done. The pounce powder will prevent the gold leaf from sticking to the body color around the gold size.

The next day the first coat of body varnish is applied. This is followed by two more, allowing 48 hours between coats.

These four coats are all that is necessary to thoroughly protect the steel from the weather. The body color is highly elastic, and will remain so as long as it is sealed in between the steel and the varnish, and will prevent the varnish next to it from hardening.

The four coats together, therefore, form a combined material of great elasticity which will expand and contract exactly with the steel, and cannot crack or peel.

Each time a car is repainted, the old surface is sand papered, given one coat of body color in oil, and three coats of finishing varnish precisely the same as a sand blasted car, saving the lettering as long as it is good. After two or three repaint jobs, it will be found difficult to distinguish these cars from those which have been surfaced.

### Opposing Arguments Answered

There has been, naturally, some opposition to such a system. Some master painters have been opposed to using methods of this kind, giving various reasons in support of their opposition. Each and all of such reasons have been duly considered in the past, and are easily and logically explained away.

Some complain that the four coats applied in this way would not leave the car smooth enough in appearance to be acceptable, therefore, they insist that more or less surfacer be used to build up as smooth a surface as possible. Right here is the big mistake. Surfacer should have no place on the outside of steel passenger cars. As an exaggerated illustration of its nature, it may be compared to a layer of clay, non-elastic, brittle and porous, drawing the life from the under coatings as well as from the outer coatings. A break down of this combination is certain.

To turn out a car with a piano-like finish is a source of pride and satisfaction, of course. The value of such a finish consists of just one thing—advertisement.

Go to any train shed, or stand on the platform of any depot, and note if the passengers first examine the outside appearance of the cars in which they are about to ride. Clean cars with a varnish luster, whether super-smooth or

not, will impress railway travelers favorably. It is obvious that it does not pay to produce an extra smooth surface.

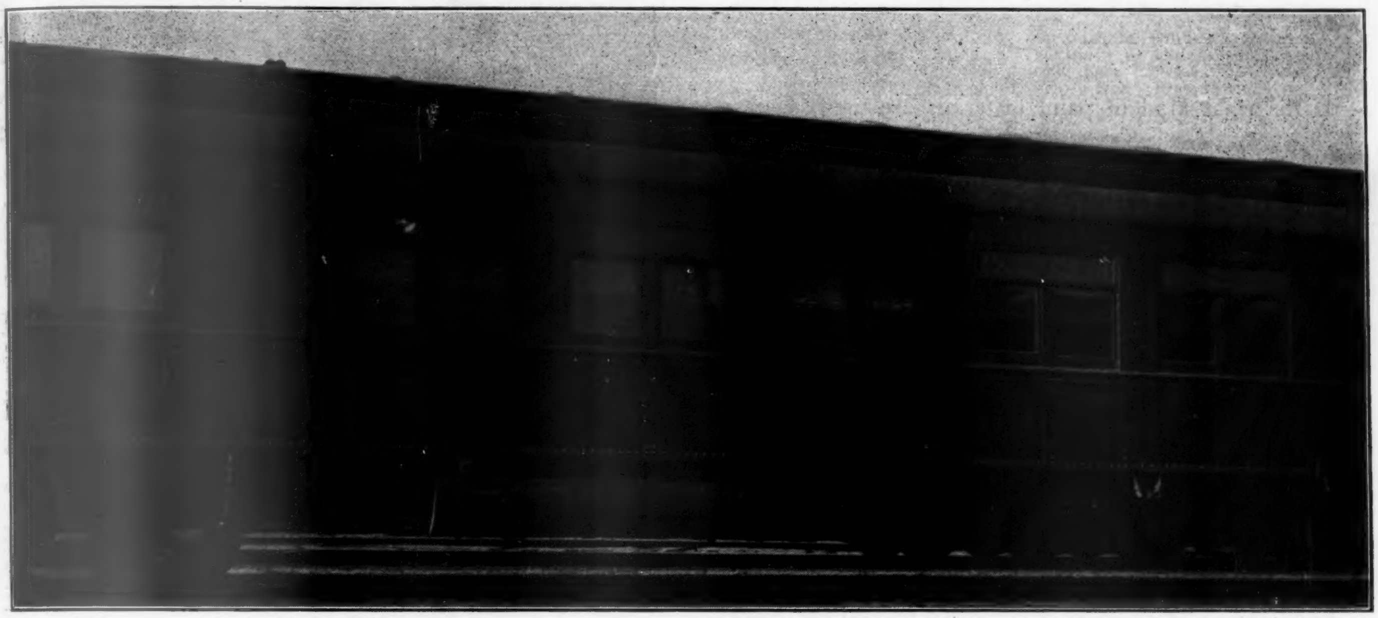
The objection has been made that a car finished with four coats only could not be wiped or cleaned readily. As a matter of fact, these cars may be cleaned just as easily as any other cars, and they are not noticeably rougher than other cars.

Another objection raised is that on some roads the steel used for the bodies is rough and full of pits. Such steel is objectionable for such a purpose.

Undoubtedly war conditions are to blame for many cars being built of such steel. It is believed that for some time past, and at present, any amount of good clean smooth steel may be had for car bodies. To those who have cars of rough steel where pits are not too numerous, the worst ones may be filled with solder and filed smooth, while the smaller pits may be ignored, as they will gradually fill as the car is repainted from time to time.

Still another objection has been offered that some of the body colors could not be applied directly to the bare steel because of lack of affinity between the two substances. This objection should not be considered too seriously, as a change of paint formula could be made which would overcome any difficulties of this nature.

It has been claimed that the territory through which the Soo Line runs is especially mild on paint and varnish, while in some other parts of the country, the conditions are much more severe. A careful check-up will disclose the fact that climatic destruction to paint is about equal all over the continent, and any paint elastic enough to expand and contract with the steel will be found to be perfectly adapted to the mountain districts of the East and West, the hot plains of



This Car Was Painted May 31, 1923

Sleeping Car "Bowbells," Painted April 6, 1923

the Southwest in summer, or the frozen prairies of the far North in winter. Some of the Soo Line steel cars are running between Chicago and Vancouver, and show no more deterioration to paint than the same class cars in local trains.

The advantages of the four coat system are:

Greatly reduced cost of materials.
Less cost for labor.
Increased durability of paint.
Less time required to paint the cars.
Greater time between sand blasting jobs.

If the right kind of paint materials are used, success is certain.

# Coupler Yoke Rivet Shearing Machine

By E. A. Murray
**Shop Superintendent, Chesapeake & Ohio, Huntington, W. Va.**

To replace a coupler yoke it is the customary practice to remove the whole gear and take out the springs and followers. The yoke and coupler are then sent to the blacksmith shop where the rivets are cut off and a new yoke is attached. In order to expedite the work of removing the coupler yoke rivets at these shops, a pneumatic shearing machine has been devised which has considerably reduced the time and labor formerly expended in this work.

Referring to the drawing, it will be seen that the machine consists essentially of a large air cylinder for operating the shear, a small air cylinder for inserting the clamping wedge at *G* and a bolster and clamp for holding the coupler and yoke. Cast iron and wrought steel have been used throughout the construction with the exception of the parts *F* and *H* which are made of cast steel. The assembling and piping pertaining to the installation were performed in the shop.

Pneumatic Rivet Shearing Machine Which Saves Considerable Time in Making Coupler Repairs

The main air-cylinder piston rod which is 3½ in. in diameter, is pivoted directly to the shearing lever. A smaller piston rod, 1⅜ in. in diameter is screwed into the upper end and operates a piston in the oil cylinder *A*. The oil cylinder is bored to 6¼ in. and is 13 in. high. The oil serves as a


Drawing of the Coupler Yoke Rivet Shearing Machine

buffer to cushion the action of the main piston when air is admitted to the cylinder *C*. A stuffing box *B* is placed between the oil and air cylinders. The diameter of the main air cylinder is 20 in. and the piston stroke is 10⅜ in. The shearing lever is fulcrumed on *K* and the blades are bolted to the shear head *J*. The coupler yoke is held in position on the bolster *H* by the clamping lever *F*. This lever is held against the yoke by means of a wedge inserted between two rollers at *G*, by admitting air into the air clamping cylinder, which is bolted to the end of the bed plate *E*. When it is desired to release the clamping lever, it is only necessary to turn a four-way cock which admits air to the other side of the piston in the air clamping cylinder and also releases the air which was used to move the wedge forward. The return movement of the piston removes the wedge from between the two rollers and a spring pushes the clamping lever up.

Both air cylinders are operated in the same manner and the various cocks are located in a convenient location for the operator. The coupler yoke may be placed on the bolster and removed from either side. This arrangement is quite convenient in case either one or two men are working, as the machine may be operated entirely from one side or from both.

# Discussions at the Car Inspectors' Convention

## Accuracy of Charging for Repairs to Bent Car Parts and Responsibility for a Shifted Load Discussed at Length

LAST month's issue of the *Railway Mechanical Engineer* contained a resumé of the opening proceedings of the twenty-third annual covention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America which was held at Chicago, September 23, 24 and 25. One of the papers included in that issue was that of B. F. Jamison on A. R. A. Car Repair Billing. Below will be found an abstract of the discussion which followed its reading. The Question Box discussion is also given in this issue.

### Discussion of Mr. Jamison's Paper

F. W. Brazier (N. Y. C.): I was much interested in Mr. Jamison's paper, but he is talking to the wrong convention. Our higher officers are the ones who do not know the importance of what he has said. I see our billing clerk here. How many million dollars a year do you bill out?

A Member: Approximately $15,000,000.

Mr. Brazier: That is more than the entire mechanical department is spending on our fast locomotives. When you get home take this up with your higher officers and when they say you must cut down expenses and lay off some of your men, explain to them that it will be taking money out of their own pockets. You know, as a general thing, when they want to lay off anybody, they start in the car department.

We have no rule that is so abused as Rule 32. I do not believe some of the decisions that the arbitration committee made, and I am a member of it, would stand water if the people told the truth, but we have to render a decision on the evidence given us by you.

J. J. Gainey (Southern): Mr. Jamison at one time was under my supervision in the car department. Unfortunately from the mechanical end, he left us and went into the auditing end. He checks in about eight general foremen's districts, which will mean eight general car foremen and probably treble that number of foremen of the car department. He is more rigid and severe on our mechanical department than the A. R. A. clerks. He checks us from every angle, even going out into the yard and checking the repairs to the cars.

He makes out a statement, one copy of which comes to me, one of which goes to our superintendent of motive power and one to our auditor. He shows all errors and omissions, under and over charges, and brings it all out in dollars and cents. He sends that in to our office and I presume our office at Washington sends a check out for all the over charges and we make our men go back and check the undercharges and bring them up. Any road that has not got a billing repair auditor is making a mistake.

Whenever he checks in a terminal he takes the general foreman out to where the inspectors are who write up those repairs and instructs them. He also gets a class of all the foremen and supervisors and talks to them if I am not there. Mr. Jamison has been a great help to the mechanical department on our railroad.

W. P. Elliott (T. R. R. A. of St. L.): May I ask, in steel car repairs where you have two different charges, one on a riveting basis and the other repairing on the car, how you divide the two?

Mr. Jamison: In the majority of cases that work is done by different men and the foreman and the work checker keep the time, with of course the assistance of the repair man himself. It is rare that the man who does the riveting does the straightening or repairing on the car.

Mr. Elliott: Our situation is different, because we have all foreign cars, and as a rule one gang cuts down in a progressive fashion and another gang fits up. That same gang when they fit up do whatever straightening is to be done on that car. We carry separate books and of course we have to rely to a large extent upon the man too. Is there anything wrong with this system that you can see?

Mr. Jamison: No. According to the regulations there should be no memorandums or records other than the original records of repairs, but I do not think that you are getting away from that if you allow, for instance, your acetylene operator to keep the amount of gas that he used on the car. Those are not original records. The original record refers to the information that is going to be given to the bill clerk. Our acetylene operator carries a book in his pocket; but each day, each hour or two, the original record man is getting that information from him and that would be the same way with your man-hours.

E. Pendleton (C. & A.): Isn't there a charge in the rule for straightening sheets?

Mr. Jamison: Yes. If the part of the car is straightened on the car it is on the hourly basis. If it is taken off the car and then straightened it is on the pound basis.

Mr. Elliott: In the operation of the acetylene welder, suppose you get a bent bolster. How do you divide that time? Your acetylene man gets a higher rate. Do you allow the blacksmith so much for straightening and the acetylene man so much for welding, or do you follow the practice of having the acetylene man do both?

Mr. Jamison: In the majority of cases he does both.

Mr. Elliott: Then you charge his time?

Mr. Jamison: Yes.

Mr. Elliott: There are a few cents difference, but it

works out about the same way. We do that and I have always thought it was a proper practice.

M. E. Fitzgerald (C. & E. I.): I do not understand the connection between the acetylene welder and the blacksmith in repairing a bent bolster, for the simple reason that the association does not recognize any difference between crafts in repairs to a part of a car. If you repair a bent part of a car you repair it on a labor basis, so much per hour regardless of who performs the operation. In welding you charge, of course, according to the material you use and the labor consumed. I think you have confused your question.

Mr. Jamison: Mr. Fitzgerald is correct. He has just gone a little farther than I thought your question intended to go.

Mr. Fitzgerald: There is really a decided difference between repairs and welding. Unless the car foreman in charge of the work understands the rules and charges the billing clerk will be absolutely confused in rendering his charge, when it reaches his office.

Mr. Elliott: I do not think I can make myself any clearer. We have presses. You do in your shop too. A bolster comes in there to be welded and it is bent. Your acetylene man does the entire job instead of turning it over to the blacksmith to be straightened and then brought back for welding. You charge so much per hour for welding plus the material.

Mr. Fitzgerald: There is a decided difference between repairing a bent bolster and welding. They are two separate and distinct charges and the record has got to be compiled so that you can clearly differentiate between the two, and the billing clerk must have that information in order to render his charges properly.

Mr. Gainey: If I understand Mr. Elliott he is speaking of a case where in heating the bolster preparatory to welding, the steel comes back to its place.

Mr. Elliott: You would not dare to charge, so much per pound for straightening and then in addition to that charge your welder's time too. You would just charge your welder's time on an hourly basis, plus the material. There isn't any limit to what you can charge for welding if you want to. The rules do not say.

Mr. Gainey: I think Mr. Elliott is absolutely right because the bolster straightens itself in the heating, and if he just charges on the hourly basis he is not overcharging. He is doing the work.

G. Reichart (C., M. & St. P.): In welding and straightening, how do you arrive at the amount of acetylene to be charged? Do you have an arbitrary charge for acetylene per hour or do you actually measure the acetylene you are using? We have an arbitrary charge of 75 cents an hour; that is, for the time that the welder actually works. We have an additional average charge of 75 cents for the acetylene and oxygen to be used.

Mr. Jamison: We use the gages.

Mr. Reichart: What does your average amount to?

Mr. Jamison: It varies. I am not very well satisfied with it. I am working with it right now, getting figures at different places. We do use an average charge of 25 cents an hour for electricity, which is just about one-third as much as it costs us, to my notion; but for the acetylene and oxygen gases we are using the gages.

Mr. Smith: We have occasion to check our inspectors and write-up men to see that they get all of the charges, and I was wondering how that was handled on the Southern.

Mr. Jamison: We can only check a portion of the yard inspector's work, that is true, because the cars are coming and going; but we feel that we get a sufficient amount of it so we will keep him lined up.

Mr. Smith: What I had in mind particularly was the fact that if you check the man in the train yard to see that he has charged everything, you will go along and find a new nut or a new shoe or a new shoe key, which looks very much as though it has just been applied, but when you go to the man he says, "I didn't apply that." What are you going to do about it?

Mr. Gainey: You must watch him and instruct him and educate him to charge everything he does, but nothing he does not do.

Mr. Smith: They are in a hurry sometimes.

Mr. Jamison: I would like to say, Mr. Smith, I don't know which we have worked on harder, "Don't charge what you don't do," or the other, "Be sure to charge all that you do."

Mr. Fitzgerald: If I was in doubt I would check the issuance of material to that particular inspector and find out if he carded me on system or foreign equipment for the particular amount of equipment issued to him for thirty days. But I would not permit an A. R. A. inspector to question whether he did or did not apply it, as to whether it was new or old. He does not know. We have got to give the car inspector a little consideration in our yards.

J. L. Flood (N. Y. C.): Mr. Jamison, on your road are the billing repair cards in the bound cards?

Mr. Jamison: Yes, sir.

Mr. Flood: And the billing repair card is numbered?

Mr. Jamison: Each billing repair card is numbered consecutively.

Mr. Flood: If you have more than one card how do you cover that?

Mr. Jamison: We staple them together.

Mr. Flood: What is accomplished through the numbering of the bill repair cards consecutively?

Mr. Jamison: When the billing cards are issued to the mechanical office from the stationer, he notifies the auditor of disbursements in Washington that he is shipping billing repair cards from number *X* to *Y*, inclusive, to this division, represented by the master mechanic's office. The auditor of disbursements holds those numbers against that district until the billing repair cards have been furnished him completed. We have a system for that which requires but little work. With each bundle of billing repair cards which have been completed that are forwarded to the office of the auditor of disbursements we have a form called 1043. It says, "Herewith billing repair cards in valuable package number blank, from such a date to such a date, from such a number to such a number inclusive."

Mr. Flood: Are your original records covering repairs made in your train yard numbered?

Mr. Jamison: No.

Mr. Flood: What protection have you against destroying the original record?

Mr. Jamison: We use the loose leaf form of original records in all of the work. We require that every yard car inspector, light repairman and air brake man, turn in one sheet each day, dated and signed. If he made no repairs during the eight hours that he was on duty he must write across the face of it, "No repairs made."

Mr. Flood: Do your original records cover the repairs to more than one car?

Mr. Jamison: Yes. The sheet is full letter size.

Mr. Flood: Then if the man made twelve repairs, eight on one sheet and four on another, your car charger, if he wished, could destroy the sheet with the eight repairs on it in order not to bill on them and you would be none the wiser.

Mr. Jamison: Our original record sheets have a numbering system up in the corner. The inspector or the write-up man who handles the original record, if he uses three sheets today, says on the first sheet, "Sheet No. 1 of three sheets." The second is "Sheet No. 2 of three sheets." The last one is, "Sheet No. 3 of three sheets." If he destroys a sheet he is going to have to change one of those numbers, and that would be evidence for a little quiet investigation.

Mr. Flood: Don't you think it would be a good plan to

number your original records as well as your billing record cards consecutively?

Mr. Jamison: We are considering that and have been for some time. It will probably be done some day, but I am not really sure of it. Personally I feel that we are getting along fine with that part of the work.

Mr. Flood: Have you run across clerks that have destroyed the original records in order to shirk their work?

Mr. Jamison: Not since we have the loose leaf system. When we had the old books we did.

Mr. Fitzgerald: Mr. Jamison, on the record receipt that he referred to, made no reference other than to say he was forwarding repair card numbers one to blank, with no reference to possible attachments of joint evidence or defect cards. It might be well to bring before the association the fact that they also should be shown on that transmission receipt form between the auditor and the car inspector, for the reason that should he send twenty repair cards, three of them supported by joint evidence or defect cards, it should be shown on that receipt. They might be misplaced in transit.

Mr. Jamison: Our form 1043 also lists the defect cards included in that package, and also our own system defect card stubs which we remit to the office of the auditor of disbursements. We do not lose our joint evidences. They are attached directly to the repair card which was issued in that case.

Mr. Fitzgerald: Should they become detached the billing clerk in the office might be confused in rendering his charge.

*(On motion of Mr. Sternberg, Mr. Jamison was given a rising vote of thanks for his paper.)*

## Question Box Committee and Discussion of Billing Rules

W. M. Pyle (S. P.): This committee yesterday at the suggestion of the chairman of the executive committee invited Mr. Fitzgerald to sit with us in considering these questions and he did so and concurs in the different recommendations or interpretations as made by this committee.

The first question that I have concerns a load of brick. It is not in the form of a question but it is a letter. I will read it.

*Question No.* 1—Brick, when loaded in accordance with the A. R. A loading rules, does not require door protection; in the cases at hand the brick had originally been loaded in accordance with the loading rules but had shifted in transit. The Pennsylvania reloaded the brick to conform to the rules and did not apply inside door protection as it was not necessary.

The fact that brick, properly loaded, does not require door protection, in our opinion, removes it from the provisions of A. R. A. Rule 2, paragraph (h).

*Answer*—It is the decision of the committee that a shifted load is a delivering line's responsibility. Originating lines can only be billed if door protection is applied.

G. Ziebold (H. V.): I will agree with the gentleman that a shifted load is the delivering line's responsibility, but there is an exception in paragraph (d) of the car service Rule 14, requiring door protection for any load rolling, shifting or coming in contact with the door in transit. That is the accepted rule.

A. Armstrong: (chief interchange inspector, Atlanta): How are we to determine that this load was loaded originally according to the loading rule? We will take it for granted that it has passed over 400 miles of road and the doors are in distress. We find that the brick is piled up against the door. How are we to determine that the brick was loaded in accordance with the rule?

Mr. Ziebold: Only from the claim of the line that claims the deduction. The man in charge of the adjusting order tells you that the car was loaded in accordance with the rule. We have got his ruling.

Mr. Fitzgerald: The question as written plainly indicates to us that the car was originally properly loaded in accordance with the rules of loading.

A. F. Owen (L. & N.): I would like to know how any one can tell when a load becomes shifted against the door whether it was properly loaded at the originating point or not. Circular 311, I believe it is, makes the originating point responsible for door protection, and it says it must be applied in the substantial manner so that the load cannot shift in transit and come in contact with the doors. If the door protection was properly applied it should not shift and come in contact with the door. Neither would the door protection become dislodged and allow the load to come against the door. I believe if any load is shifted against the doors, not in unfair usage, a bill is properly rendered against the originating point.

B. F. Jamison (Southern): Just in case he should apply inside door protection. Otherwise his bill would be void.

Mr. Owen: I believe that any load that can shift against the door should have door protection originally, and if it cannot shift against the door you will not find it against the door.

J. E. Vittum (chief joint inspector, Columbus, Ohio): This question comes from our interchange district and therefore I have a part in this discussion. It was brick which I understand originated on the C. & O., was delivered to one of our railroads in Columbus, and when it passed the receiving line's inspection point, it was found that part of the load had shifted against the door. Of course, our inspectors are not permitted to break seals or to examine the load and know whether or not it is loaded in accordance with the requirements of the loading rule. But the load was disarranged; it had to be moved to the shop for proper adjustment. It moved to the receiving company's shop and there it was found when they opened the door that the brick had been properly loaded according to the requirements of the loading rules. Nevertheless that did not hinder some of the load from shifting from its regular place and falling against the door. Therefore, it became a necessity to adjust the load. According to our opinion it had been improperly handled. Therefore, since the delivering line did something, either by unfair usage or otherwise, so that part of the load, although properly loaded in the first place, did fall against the door, we thought it sufficient authority to issue adjustment orders so that the load might be adjusted in such a way as to require no loss of lading as the load moved forward.

Mr. Ziebold: Was there any evidence of that car being in trouble or roughly handled? Was any brick damaged? Bricks have to be properly loaded to be loaded in accordance with the loading rule, and they certainly were not thus properly loaded, in my opinion, or they would not have shifted.

Mr. Vittum: My attention was not called to the load before the adjustment was made, so we had to take the word of the receiving line. The conditions which surrounded the case would imply that there was improper handling of the car.

T. J. O'Donnell (chief inspector, Niagara Frontier Car Inspection Bureau): The setting of brick according to the loading rule does not prevent shifting. I think your committee has solved this the only way they could do. The delivering line is responsible if the originating line stepped the brick at the doorway as the rules demand. I was going to recommend, when we make our changes in the rules, that this rule be amended because brick will not stay in place on the stepping arrangement that the association has outlined.

Mr. Fitzgerald: Mr. O'Donnell has practically covered the conditions, as they exist, and the committee I feel have properly handled the question before them. I believe the executive committee will welcome a recommendation to be later placed before the loading rules committee to correct or amend the present loading rules to provide for door protection for brick so it absolutely will not move in transit if loaded according to the rule.

C. F. Straub (Reading): I move that the committee's recommendation be accepted.

***(The motion was seconded and carried.)***

*Question 2*—Wooden underframe car is received from the connecting line with four broken longitudinal sills and handling line breaks two additional longitudinal sills. Does such a car come within the scope of the footnote under Rule 43, and if so how can the handling line comply with the requirements as to furnishing the car owner with a statement as to the circumstances under which the damage occurred, except for the two sills damaged in its handling of the car? In the absence of a receiving interchange record of the old sill damage, would personal inspection by the chief interchange inspector be sufficient to prove that part of the damage occurred prior to receipt of the car and absolve the handling line of responsibility for the old damage?

*Answer*—The handling line is responsible. We did not attempt to answer those other questions regarding the method to be employed in finding out about the other sills that were damaged.

J. J. Gainey (Southern): I move that the interpretation of the committee be accepted.

W. P. Elliott (T. R. R. A.): I do not agree. I asked the question. The question was if we received the car with three broken sills and we broke three more. The rule says the company on whose line six sills become damaged (there were not six sills damaged on either fellow's line) must furnish the owner a statement. We claim that is the owner's responsibility. The only thing they would be required to do in that case would be to prove by an interchange record or an inspection that that car was received with three broken sills. I think that the arbitration committee that made these rules contemplated that you must break six sills before it was a handling line responsibility. In this case you are not breaking six sills. Another fellow will put up the argument that you could have protected yourself when you took that car. I would just like to call you back. What would you say of a man who stopped every car with three broken sills? You would say he was crazy. I claim the rule is intended to take care of just such a condition that if you do not damage six sills you cannot give this man a statement and you do not have to. Under the rule I claim that that car was not unfairly handled as contemplated in Rule 32.

Mr. Fitzgerald: The arbitration committee says that when the car on your line develops six broken sills you must tell the owner how the damage occurred. The arbitration committee, through the various associations, have given us Rule 2, which is that empty cars offered in interchange must be safe and serviceable. The car was received with four broken sills. He had the option of transferring it if it was loaded and returning it to the delivering line, properly protecting it against further damage. If it had burned up he would have been responsible. If he had further damaged it he was responsible. He had the option if the car was empty of rejecting it. He did not do so. He operated the car and further brought about a combination of six broken sills and he must say how he broke those six sills. Four of them were broken when he received it. Now if in handling he broke two further sills he must clearly define to the owner of the car how that car was operated and he has no question before him except to show that he gave the owner fair service. In the absence of that information he is responsible to the car owner for complete repairs to the car; and if you refer to arbitration decisions you will find that the old sills have no significance whatever in settling such a question. There are numerous arbitration decisions to the effect that if he handles a car with broken sills he is handling the car improperly. He should have repaired it and billed the car owner.

A. S. Sternberg (B. R. C. of Chicago): I would like to go along with Mr. Elliott if it was possible. I think the handling line will be held responsible in a case of that kind. It is a very unfair proposition especially to a switching line, because we get cars from trunk lines every day with two to three sills broken and in handling and switching them we probably break a couple more. I do not believe we can get out of it. I believe that the handling line will be held responsible.

Mr. Elliott: The rule does not say that "if the car develops six broken sills." It says the company on whose line those six sills or any six sills became damaged. There isn't any arbitration case similar to this. I think the decision of the committee is wrong according to the rule. I do not believe the Arbitration Committee ever intended that in a case like this the handling line should be responsible unless they actually damage the car.

Mr. Jamison: According to this rule he must furnish the car owner with a statement. Now what would this particular line's statement be? It would be a copy of the interchange record, showing that four sills were broken before the car was delivered to him and two subsequently, and it seems to me that any fair car owner ought to accept that statement. The owner, when he gets a bill from you for six sills, is entitled to a statement. Your statement should only be as far as your knowledge went, which in this case would be perfectly clear, that you received the car on interchange with four sills broken and broke two later.

Mr. Fitzgerald: Mr. Jamison is in a sense correct. The only thing required of the railroad that handled this particular car is to show it received the car with four broken sills and that it handled the car absolutely fairly in accordance with Rule 32. Now reverse the same proposition and accept the car in first class condition, with no sills broken, and break the six sills on the Terminal Railroad of St. Louis. If you can show to me that you handled that car fairly, according to Rule 32, we will accept your bill for the six sills or we will authorize you to destroy the car. I cannot see any argument with the two sills versus the six sills. It is not up to the car owner to question the man as to how he received the car. It is as to how he handled it after he got it on his line. He must move that car in such a manner that he will not violate the provisions of Rule 32, and if he does that we have all got to pay him if he damaged eight sills in the car or broke the car completely in two.

*(The members voted in favor of the decision as rendered by the committee.)*

*Question 3*—Rule 32, fourth paragraph, Section D, reads: "no rider protection *when necessary*, if car is damaged to the extent shown in footnote to Rule 43."

Define clearly the circumstances under which rider protection *is necessary*.

*Answer*—When cars are handled over hump or cut loose from engine while in motion, such as kicking or dropping cars.

*(On motion, the answer of the committee was approved.)*

*Question 4*—What is considered the safe limit of speed for switching in a classification yard without rider protection?

*Answer*—Beyond the committee's jurisdiction.

*(On motion, the interpretation by the committee was accepted.)*

*Question 5*—If derailment is due to any of the following reasons, should the car owner be billed for expense of repairs for any damage occurring before said derailment?

1—Coupler or attachments pulling out and falling to rail.

2—Car breaking in two, then derailing or parts of body falling to ground.

*Answer*—It is the delivering line's responsibility.

A. G. Lyon (N. Y. C.): The owner would be responsible for the coupler pulling out that causes the derailment. For any damge before the derailment it is the owner's responsibility.

A. F. Owen (L. & N.); There is a provision in the rules for the owner being responsible. Therefore, the coupler itself would be on the owner's responsibility. I think there should be two decisions on that. They are two independent questions. One is a question of damage to equipment due to a coupler pulling out or a coupler breaking, and another is due to a car being derailed. All the decisions ever rendered by the arbitration committee made a derailed car a handling line responsibility, and their decision on a coupler pulling out, damaging an axle, bending or tearing off brake beams or other like damage to the car makes the owner responsible.

J. J. Gainey (Southern): I think the report of the committee is correct. If in backing down through the yard a freight car breaks in two by buckling and one or two wheels drop to the ground you cannot charge the owners for the sills.

Mr. Fitzgerald: The provisions of A. R. A. Rule 32, plainly read that if a car is derailed, cornered or side swiped, the handling line is responsible, and I believe that if the gentleman who made the issue in this particular case will refer to arbitration decisions he will find 40 to support our argument and the argument of this committee to the effect that when a car is derailed the car owner must be paid by the

handling line for all damage. If you will just look at the situation clearly and fairly, we would evade the issue in 90 per cent of the cases if we had access to the argument that the car broke in two before it derailed. Whenever the car is derailed the handling line pays the bill, and there are numerous cases to support our argument.

Mr. Elliott: I do not see how Mr. Gainey can reconcile himself with the decision of the committee on Rule 41 when they say the car was found damaged with other defects which are ordinarily owner's responsibility. Such defects may be repaired at the car owner's expense. This car we speak of here is a flat car broken in two, with one pair of wheels derailed. The rule says very plainly, "If caused by derail." Up to that time it is the car owner's proposition. After that the car handler's. Prior to that time we can bill the owner. After that time we cannot bill the owner. That is what Rule 41 says. I do not see how you can take another position. I remember one of these representative cases that you refer to. It says the car was derailed and damaged. I am talking about a car that was damaged and derailed. Your case was just the reverse of the case I am talking about.

Mr. Smith: I agree with the sentiment expressed by Mr. Gainey. We bill for broken wheels. Say, for instance, the car is descending a mountain and the wheel breaks and causes a derailment, we bill for that wheel. We bill for a truck side that fails. We bill for a coupler that fails. But we have not gone as far as going into any such damage as breaking the car in two.

Mr. Elliott: I do not believe we ought to go on record as deciding a case so contrary to the rules as that. It will look bad to any one.

B. F. Jamison (Southern): My instructions from my superiors are to see that only just bills are rendered on our line. Whenever you get into that close box of having a damage that occurred previous to a derailment and during derailment you are getting down so fine that somebody is going to slip if you do not take the safe line. My instructions wherever I go are to take the safe side, and if the car was derailed we make a no-bill.

(*The members voted in favor of the committee's decision.*)

*Question* 6—Should we get three-tenths of an hour per bolt for short bolts used in repairing running boards on tank cars or should we be paid on a bolt basis?

*Answer*—As per items 91 and 91-A of Rule 107.

*Question* 7—What service metal is to be shown on a repair card for steel wheels applied that are not full flange contour?

*Answer*—The amount of service metal as shown by wheel gage after wheels are turned to full flange contour.

*Question* 8—We issued a defect card for a cut journal and owner changed wheels, charging us for a new axle less S. H. Can owner charge us for betterment to his own car, 1923 repairs?

*Answer*—No.

This has to do with Rule 86.

*Question* 9—Where axle is removed on account of delivering line responsibility with wheel seat below limit of wear and is replaced with one having all required dimensions, who is responsible for the difference in value?

*Answer*—The delivering line is responsible.

*Question* 10—Where axle is removed on account of delivering line responsibility and wheels condemned with remounting gage, who is responsible for value between scrap and second-hand?

*Answer*—The delivering line, interpretation No. 3, page 108, Rule 98.

*Question* 11—Rule 91. Should offset or recharge authority be given for an amount less than 25 cents if it is found that car on which charge is made was not on line of billing road, on the date of bill?

*Answer*—Yes.

*Question* 12—Rule 17. Is application of a 5-in. by 7-in. coupler in place of a 5-in. by 5-in. wrong repairs where provision is made or exists for ¼ in. in clearance of coupler shank?

*Answer*—Yes.

*Question* 13—Rule 60. Should offset or recharge authority be given for not obliterating old stencil marks, in connection with cleaning air brakes, where the second cleaning is done 9 or 12 months after date it is claimed was not obliterated?

*Answer*—Yes.

*Question* 14—Rule 11. Is there any method of determining the thickness of lining in journal bearings other than gaging prior to rebabbitting?

*Answer*—No.

*Question* 15—Rule 12. Should defect card be requested on joint evidence obtained more than 90 days after first receipt of car home?

*Answer*—No.

*Question* 16—If a 5-in. by 7-in. coupler is applied in place of a 5-in. by 5-in., or if a 5 in. by 5-in. shank, 9⅛-in. butt coupler is applied in place of a 5-in. by 5-in. shank, 6½-in. butt coupler and shortly after the wrong coupler is removed broken, is repairing line (car owner or foreign company) justified in charging for new or second hand coupler according to what is applied and allow credit for scrap body on authority of the defect card covering the wrong coupler applied?

*Answer*—Allow credits according to condition of parts of coupler removed, charging either for new or second-hand according to which is applied. This has to do with Rule 91.

*Question* 17—Rule 91, paragraph C, states: if exceptions do not amount to 25 cents in the aggregate, no exception shall be taken.

Some companies are taking exceptions to wrong car numbers when aggregate of charge is as small as five cents and insist that paragraph C does not apply to wrong car numbers. What is the opinion of the committee in this respect?

*Answer*—Paragraph C does not apply to wrong car numbers.

*Question* 18—If air brakes are cleaned the second time within nine months and the repair card of the company doing the last cleaning shows old stencilling which does not agree as to date and name of the company performing the previous cleaning, will Arbitration Case 1278 apply or does the card of the company doing the last cleaning act as joint evidence showing that the company doing the first cleaning failed to stencil car properly?

*Answer*—Intermediate road's repair card acts as joint evidence and is final.

*Question* 19—Some companies, prepare repair cards covering repairs to their own equipment and match it with repair cards they receive from other companies. There are numerous instances where companies doing so use their repair cards as joint evidence showing that cars are not stenciled for D type couplers, and that D type couplers were not applied.

Are we to accept such evidence as final and within the spirit of the rules when such cards are submitted with repair cards covering repairs made six months or two or more years previously and showing D type coupler applied and car stenciled?

*Answer*—No. Owner must secure joint evidence within 90 days.

*Question* 20—A road submits joint evidence as follows: Repairs made—One. A. R. A. standard; 2, brake beam, top hung. How repairs should be made—One, A. R. A. standard; 2, brake beam, center hung.

Should defect card be issued? If so, what should it cover and what charge should be made on authority of the defect card after the alleged wrong repairs are corrected?

*Answer*—Labor only.

*Question* 21—Through oversight, statement as required by Rule 43 is not furnished car owner with bill. On complaint from car owner the repairing line furnished the statement, which is accepted as showing the circumstances under which the damage occurred; however, car owner declines to accept charge on account of failure to attach statement to repair card when bill was presented.

Is car owner's action warranted by the spirit of the rules?

*Answer*—No. However, repairing line should have complied with Rule 43. It was the opinion of the committee that the decisions of the arbitration committee allow the correction of a repair card when it complies with the original record, and it was the opinion of the committee that this was just the same.

*Question* 22—What is the proper charge for a National metal bound door for ordinary box car?

*Answer*—Item No. 147. $11.20 each.

*Question* 23—What is the proper charge for a reinforced door having two longitudinal metal stiffeners and one vertical metal spark strip?

*Answer*—Item No. 148. $18.75.

*Question* 24—What is proper charge and credit when Westinghouse friction draft gear is removed on account of spring and segments broken and Miner friction draft gear applied instead? It is understood that all parts of gear removed are good except segments and spring.

*Answer*—Scrap and second-hand for parts removed.

*Question* 25—What is the proper charge when a National metal bound door is removed from the car and all door siding and battens are removed on account of decay, and the bolt labor and material exceeds the price of new door? What would be the proper charge if same door was missing?

*Answer*—$11.20.

*Question* 26—If a defect card was issued to owner for wheels and axles missing, would the charge be proper for value of new wheels and axles or second-hand value?

*Answer*—Second-hand value.

*Question* 27—Is it proper to charge McCord and National journal boxes at manufactured price per Rule 105 or on a pound basis?

*Answer*—Pound basis for malleable iron.

*Question* 28—Does the price of journal box include the lid, or should the lid applied be charged separately and credit be allowed for lid removed separately?

*Answer*—No.

*Question* 29—When billing for repairs made to tank car on authority of a defect card must the labor for each operation be shown or simply lump sum hours covering boiler-maker work on tank shell? Some companies show the actual hours for each operation on the shell while others only show total hours worked on the barrel.

*Answer*—Where available, labor should be shown separated for each operation.

*Question* 30— Road *A* cleaned the air on *B* car, 9-29-23. Road *C* cleaned the air on this same car 6-17-24 and reported the old date as 6-29-23 by *A*. Is the *C* repair card evidence that *A* did not properly stencil the car or is the *A* repair card evidence that *C* misread the stenciling applied by *A*? Does the principle involved in arbitration case No. 1278 apply?

*Answer*—Yes. Rule 90 must apply.

*Question* 31—Road *A* cleaned air on *B* car 46,789, 6-14-23. Road *C* cleaned air on this same car 6-18-24, reporting old date as *D* 7-19-23 by *D*. Note air brakes have not been cleaned twice in nine months. Do arbitration cases 1251-1252 and 1304 apply? Does interpretation No. 2, Rule 60 apply? Would both charges be proper because of rules requiring that air brakes be cleaned once each 12 months?

*Answer*—The committee suggests that you accept the charge.

*Question* 32—*A* cleaned air on *B* car 9-29-23. *C* cleaned air on this same car 6-17-24, and reported no stenciling on car. Is the *C* repair card final evidence that *A* did not stencil the car? Can it be assumed that a car would operate more than eight months without stenciling on air brakes?

*Answer*—Yes.

*Question* 33—Is failure to show railway company initials on new wheels applied sufficient ground for demanding reduction in charge to second-hand? Rule 9 states they should be shown.

*Answer*—No.

*Question* 34—Is the application of liners between center plates on foreign cars chargeable to car owner in any one case?

*Answer*—No.

*Question* 35—What is the proper labor charge for wood truck spring shims applied at the same time metal shims are applied between arch bars, the reason for applying both being that the wood shims would not raise the car to standard height?

*Answer*—Material only.

*Question* 36—When a defect card is granted for a wrong triple valve applied, is it proper to clean air brakes and bill for it against defect card for wrong triple valve?

*Answer*—Yes.

*Question* 37—What is the proper charge for rehanging a sidedoor (one hanger) off the track when no repairs are necessary?

*Answer*—Four-tenths of an hour. If any other repairs are necessary they must be made. Item 144, Rule 107, Supplement 1.

*Question* 38—What is the proper charge when a sidedoor is replaced in the bottom door guide and no repairs are necessary?

*Answer*—The same as in the case of Question 37.

*Question* 39—When joint evidence is presented covering failure to properly stencil air brakes, what refund is proper to car owner? Should we cancel charges for retainer valve cleaned and dirt collector cleaned, as well as the cylinder and triple valve? Must we refund our entire charge on the air brakes including packing leather?

*Answer*—Yes.

*Question* 40—Rule 32 makes outlet valve cap cardable in interchange when missing. Some tank cars are equipped with a standard 5¼-in. outlet cap, and also a 2½-in. cap which screws onto the 5¼-in. cap. Would this 2½-in. cap be cardable if missing separately? Other tanks have a plug in the outlet cap. Would this plug be cardable if missing separately?

*Answer*—Yes.

*Question* 41—In order to make a packing leather leakage test on a car equipped with a weight type retainer we disconnect the retainer pipe at the exhaust port of the triple and union in order to place the gage in the triple valve. Can we make a charge against the car owner for these two pipe connections; also for the gasket when applied to the union?

*Answer*—No. And you must perform this service each time.

Mr. Elliott: I was just wondering if everybody would make the plug in the bottom of the outlet cap a delivering line's responsibility. I don't believe I would.

P. F. Spangler (St. L.-S. F.): I think it is a cardable defect. For a metal bound National side door for a box car the committee says $11.20. The frame cost that much from the manufacturer. What constitutes a metal bound side door? The committee says one with two longitudinal metal stiffeners and one vertical metal spark strip carries $18.75. Why don't we get $18.75 for the National side door?

Mr. Pyle: Because it does not carry the two longitudinal strips as required by the rules.

Mr. Spangler: It carries two vertical and two longitudinal, all riveted together as one solid frame.

Mr. Pyle: But they are around the frame of the door, not across the door.

Mr. Spangler: We have found short switching lines specializing on removing National side doors to replace the siding and they collect $18.75 apiece for them. They do not put any new frames on them. They just iron out the old frames and renew the battens and siding. This was on our National doors on the government box cars, two doors to the car, costing us about $37.50 a car to get the sidings and battens removed on a metal bound door.

In Question 34 about the liners: The rule says if it does not reduce the vertical bearing surfaces between the center plates. What is the vertical bearing surface between the center plates?

Mr. Fitzgerald: Whenever you place a filler between two center plates you naturally raise the top center plate out of bearing in the bottom center plate and reduce the area of the top center plate as it fits into the bottom one. It is contrary to all rules and good practices and further there are few railroads that do it.

Mr. Spangler: I believe that ought to be on the flat base center plate but not the bell shaped center plate. You can get the liner so that it does not reduce in vertical bearing surface. I do not believe it is good practice, but the rule says we can if it does not reduce the vertical bearing surface.

Mr. Fitzgerald: It must reduce it by the amount of the material you put in there to raise your car.

There is an inconsistency in the rule in connection with the side door, as written; and as the rule is written the committee could not otherwise interpret it. But the metal bound door that he refers to carries more material and is possibly worth more money than are some doors that comply with the following rule which permits of a charge of $18.00, and it should be considered and probably will be by the price committee. But under the rule it could not be otherwise interpreted.

Mr. Pyle: Every one of us makes mistakes. This question box committee is in its infancy. I don't know whether I shall be on it any longer or not. But we have tried to place an interpretation on each and every question that was asked us that we thought was fair and in accordance with our understanding of the rules.

*Question* 42—Owner receives car home carrying defect card reading as follows: "Two wrong framed draft timbers, two sections body truss rods missing." What is the proper charge?

*Answer*—Labor and material, as per Rules 101 and 107.

*Question* 43—Is a bent axle a delivering line defect in all cases? If so, why reference to Rule 32, in Rule 84?

*Answer*—Delivering lines' responsibility in all cases.

*Question* 44—A road removes a pair of Davis cast steel wheels on second-hand 80M axle on account of wheel L-1 having a vertical flange. It applies a pair of 33-in. cast iron wheels on second-hand 80M axle, attaching defect card to cover. The car is delivered to connection which in turn delivers to one of its connections with wheels R&L 1 slid flat 2½ in. Defect card is issued against delivering line covering one pair of slid flat wheels, R&L 1. The line receiving the car perpetuates wrong repairs by applying a pair of new 33-in. cast iron wheels on second-hand 80M axle, and delivers the car to the owner who makes standard repairs by applying a pair of new 33-in. Davis cast steel wheels on second-hand axle. Advise proper billing for each of the four lines interested.

*Answer*—The committee finds there are three lines interested. The first road should bill the owner for the value of second-hand wheels applied, allowing proper credit for wheels removed, as per interpretation No. 4 of Rule 98, Supplement 1, 1923 Code. The second road bills as per interpretation No. 8 to Rule 98. The owner shall bill on the road making the wrong repairs on authority of defect cards for the new or second-hand cast steel wheels applied, allowing credit for the second-hand wheels removed.

*Question* 45—A train pulling into the yard makes a service application to stop. One all wooden car breaks in two, all six longitudinal sills being broken at the body bolster. This damage we understand to be owner's responsibility. This car telescopes the next car, breaking in the end of the car. Who is responsible for the repairs to the second car?

*Answer*—The handling line. See Rule 32, item O.

*Question* 46—When air brakes are cleaned the second time within 60 days on the same line, and no charge can be made for it, can the charge be made for renewing parts not included in the charge as per Rule 111, item 29?

*Answer*—Charge for packing leather, cylinder piston and rod, non-pressure head, brake cylinder, reservoir, triple body. Charge material and labor as per note following Rule 111, item 29. Make no charge as per Rule 111, item 29. That refers to labor and material.

*Question* 47—Can any additional labor be charged for renewing a box lid which is broken or missing, when its box is renewed on account of being defective?

*Answer*—No.

*Question* 48—What labor should be charged for a journal box applied associated with arch bars renewed?

*Answer*—The same as when associated with wheels, item 222, Rule 107.

*Question* 49—Should a defect card for improper repairs or damage, issued at a later date than when repairs were made, or when damage occurred, bear the date of issue or the date of repairs or damage?

*Answer*—It should bear the date when the improper repairs were made or the damage occurred.

*Question* 50—Should a Bettendorf truck side be charged as per Rule 105 or 101, it being understood that these types of truck sides are manufactured by more than one company, i. e., Bettendorf and Scullin?

*Answer*—According to Rule 101 the new type of these truck sides manufactured by both companies are interchangeable, and are alike in all particulars, therefore they can be purchased from more than one company.

*Question* 51—When air brakes are cleaned as per Rule 60 and charge made as per Rule 111, item 29, and at the same time the brake cylinder, the reservoir or both are renewed, should there be any rduction on account of overlap labor from the items shown in Rule 111, for the R&R of these parts?

*Answer*—Yes. Deduct the detail amount of all items covered by the details of both items.

*Question* 52—Rule 105, Interpretation No. 1: Where the stores department has no price on a manufactured article, on account of not having it in stock, at the point of repairs, is it correct to use the price at the factory obtained from quotations furnished by the manufacturers, plus 15 per cent?

*Answer*—Yes.

*Question* 53—Would Farlow attachment draft gear missing complete with coupler come under Rule 95?

*Answer*—No, as it is not a friction draft gear, nor would its pocket, springs and followers.

*Question* 54—Item 21, Rule 101: Is the cylinder piston follower included in the charge of $4.14 as per Rule 111, item 29, when renewed because of being broken?

*Answer*—Yes.

*Question* 55—Can the work be performed as mentioned in the note following item 29 of Rule 111, when a car is on the repair tracks or in the shop when it is possible to clean and repair air brakes as per Rule 60?

*Answer*—Yes, but it is very poor practice, and the evident intention of the note referred to was to cover emergency cases in yards.

*Question* 56—What credit should be given for a triple valve body when removed on account of being broken? Do you allow any credit for the brass parts, and if so where do you get the weight?

*Answer*—Credit for all parts removed should be given according to weight and class of material. Obtain the actual weight of cast iron as per item 111 of Rule 111, the actual weight of brass parts as per item 162, of Rule 111.

*Question* 57—Should original records and repair cards show—"No other damage involved" when only minor repairs are made to safety appliances, such as running board, extension block, or bracket bolts, coupler release lever, brackets, or hand holds, where there was no other damage to car?

*Answer*—The original record should show this information. It will not be necessary to show it on the repair card.

*Question* 58—Item 144 of Rule 107 Supplement No. 1: If the original record only shows, "Side door replaced in guide brackets, permanent repairs," and does not show how permanent repairs were made, is this sufficient information to justify charge, or should original record show how permanent repairs were made such as door guide bolts applied or tightened?

*Answer*—The original record and billing repair card should show all the work performed. However, the statement which has been added to this item "Provided necessary permanent repairs are made to prevent recurrence," is intended to be explanatory of how the work should be performed; in other words, all repairs necessary must be made.

*Question* 59—Item 105A, Rule 107, column casting rivets to spring plank applied; does the labor charge of 1.6 hrs. include the labor and material of rivets, or do you charge extra as per items 439 and 440?

*Answer*—Charge as item 105A; i. e., 1.6 hrs. cover all labor, including the labor of applying rivets. If weight of wrought rivets amounts to more than ½ lb. weight may be charged.

*Question* 60—Item 18 of Rule 107: Can you charge for jacking up the car when an arch bar tie strap is applied, nuts only R. & R.?

*Answer*—The charge of 1.1 hours covers the R. & R. of nuts only, and when it is necessary to jack the car it may be charged additional. It will usually not be necessary to jack a car, but under some conditions if car is loaded it may be.

Mr. Pyle: I have 42 other questions that are unanswered for the want of time.

Mr. Jamison: Last year we had a similar condition to this and the association gave us the privilege of answering those questions following the meeting and they were published as an appendix to the proceedings.

H. J. Smith (D., L. & W.): I move that we incorporate the unanswered questions, so that all those receiving copies of the minutes will have the benefit of the late answers.

(*The motion was seconded and carried.*)

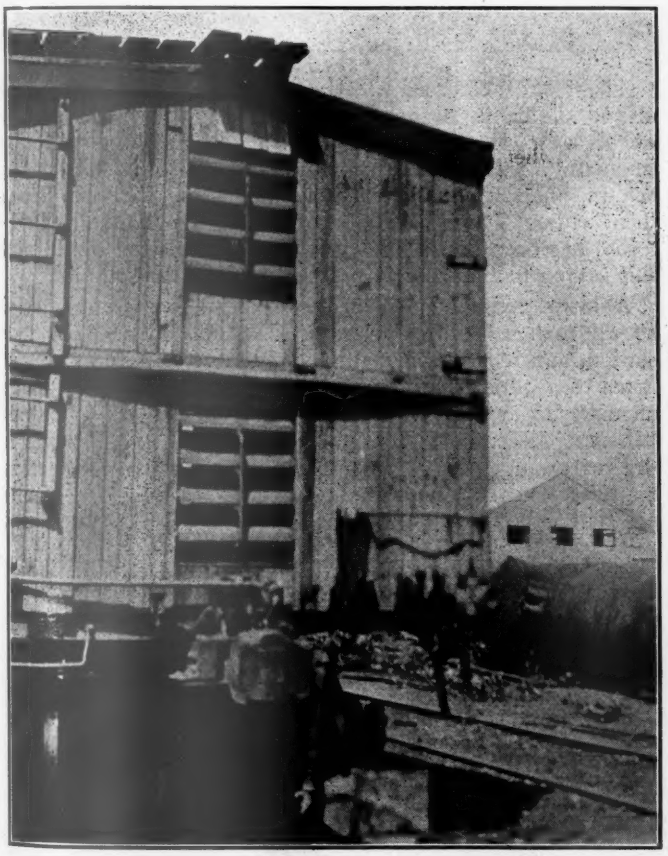
Mr. Armstrong: I think all of us appreciate the fact of the enormous amount of work which this committee has performed and while we have been recreating they have been laboring. I move you we extend to this committee a rising vote of thanks for their work.

(*The motion was carried.*)

# A. C. L. Rebuilds Ventilated Box Car in $6\frac{1}{2}$ Hours

## Entire Car Completely Overhauled and Ready for Service in a Total Time of $64\frac{1}{4}$ Man Hours

SEVERAL months ago the straight line or station to station method of repairing or rebuilding cars was inaugurated at Emerson shops of the Atlantic Coast Line. This method was entirely practicable, due to the fact that there were a large number of cars of virtually the same design requiring rebuilding. Very recently considerable comment has originated on account of time records which have been made in the rebuilding of some particular car. Believing that the station to station method of rebuilding cars is much superior to the other methods which have been in use in the past, and which are still employed at a great many shops, it was decided to attempt to completely overhaul a car during an eight-hour working day using the station to station method of repairs.



The Bent End Sill and Broken Sheathing Indicate Something of the General Condition of the Car Before It Was Repaired

A. C. L. 33291, which is a double felt-lined, ventilated, 60,000-lb. capacity box car, was selected as the car to be rebuilt. Promptly at 7 a. m. on August 7, 1924, the work of dismantling this car was started. All wood was removed, leaving the steel underframe and trucks. The steel underframe, which required the renewal and reinforcement of two steel ends, was repaired; the trucks, draft gear and air brake were completely overhauled, and the wood superstructure was rebuilt new complete. The entire task of dismantling the car, repairing the steel underframe, trucks, draft gear, and air brake, as well as the application of the wood body, including a priming coat of paint, was completed at 11:52 a. m., a total working period of 4 hr. 52 min., or a total of $61\frac{1}{4}$ man-hours.

At 8:00 A. M. the Superstructure Was Completely Dismantled

A second coat of paint was applied, the car lettered, weighed light and ready for service at 2 p. m., a total working period of 6 hr. 30 min. and a total man-hour expenditure of 64 hr. 14 min.

The various operations and time required for each were as follows:

Condition of the Car at 7:00 A. M. Before Dismantling Was Begun

| Operation | No. Men | Min. Each | Applied Man-Hours Hr. | Applied Man-Hours Min. |
|---|---|---|---|---|
| **7:00–8:00 a. m.:** | | | | |
| Dismantle car; all wood parts removed | .. | .. | 7 | 40 |
| **8:00–8:40 a. m.:** | | | | |
| Repair steel underframe, overhaul trucks and draft gear* | .. | .. | 9 | 40 |
| **8:40–10:15 a. m.—Apply wood framing to car:** | | | | |
| Side nailing sills | 2 | 25 | 0 | 50 |
| Nail sills and sub floor | 6 | 70 | 7 | 0 |
| Decking | 4 | 24 | 1 | 36 |
| Side and end plates and roof carlines | 4 | 50 | 3 | 20 |
| Corner post fillers and end frame fillers | 4 | 35 | 2 | 20 |
| End vents | 2 | 15 | 0 | 30 |
| Side braces | 2 | 18 | 0 | 36 |
| Body rods | 4 | 27 | 1 | 48 |
| Belt rail and belt rail fillers | 6 | 20 | 2 | 0 |
| Roof purlines | 2 | 15 | 0 | 30 |
| Total | | | 20 | 30 |
| **10:15–11:52 a. m.—Finished car applications:** | | | | |
| Siding | 8 | 40 | 5 | 20 |
| Lining | 5 | 40 | 3 | 20 |
| Roof sheathing | 2 | 27 | 0 | 54 |
| Door tracks | 2 | 32 | 1 | 4 |
| End tie plates, push poles and corner bands | 2 | 35 | 1 | 10 |
| Fascia boards | 3 | 10 | 0 | 30 |
| Murphy XLA roof running board extensions | 4 | 39 | 2 | 36 |
| Safety appliances side door guides, stops, brake stops and uncoupling levers | 8 | 35 | 4 | 40 |
| Brake rods | 1 | 6 | 0 | 6 |
| Overhead lining | 4 | 29 | 1 | 56 |
| Air brakes and re-pipe | 3 | 36 | 1 | 48 |
| Total | | | 23 | 24 |
| **11:52 a. m.–2:00 p. m.:** | | | | |
| Apply second coat of paint, letter and stencil car | .. | .. | 3 | 0 |

* Repairs to underframe included 2 steel end frames, 2 new body center plates, 1 new end sill, 1 new diagonal brace, 4 steps removed and riveted back to position and 4 grab irons removed and riveted back to position.

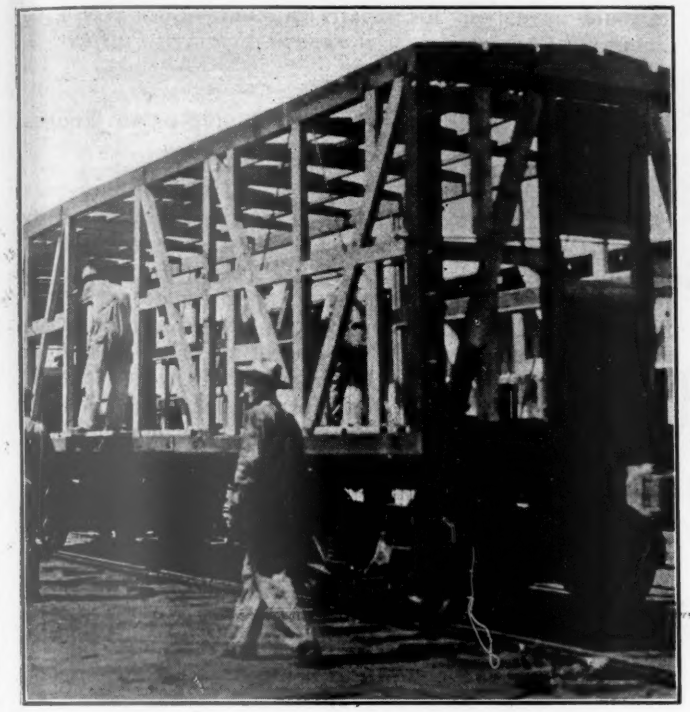
The results obtained clearly demonstrated the advantage of the station to station system of rebuilding. This system allows a concentration of material at certain points which is impossible when other methods are in use. Bolts, nuts, screws, etc., are placed in racks where the men can reach them without leaving the job. A saving in time which heretofore has been impossible even to measure is the result, and this saving is immediately reflected in increased output.

A large saving also is made in the delivery of material as all material of one class is delivered to one place or station, and it is not necessary to deliver a hundred different items to a hundred different places. Delays due to waiting on material are also eliminated and a large gain in output per man is secured in this manner. A further advantage is the increased efficiency due to the training the men get in applying one particular part to the car. In fact, the results are that a body of experts build the car with a speed and


The Job Was Completed at 2:00 P. M.

uniformity of work turned out impossible under any other system. Another advantage is the large increase of work turned out on a given amount of track space; in fact, if the station to station method is adopted, the output can be nearly doubled with the same track facilities.

When cars are rebuilt out-of-doors, it permits the priming of car siding immediately after application, whereby a large



At 10:15 A. M. the Body Frame Had Been Rebuilt

saving can be made as it has been found that a great many times new siding has to be replaced because of the fact that the wood gets wet before the application of a prime coat of paint.

The greatest saving of all, however, is in the decreased length of time equipment is held out of service for repairs. Under older methods, equipment was out of service from 20 to 40 days, even after it had been placed on shop tracks for repairs. When station to station methods are used, cars can be scheduled through the shop in any definite period, which, including painting, should not exceed 10 days.

# Rebuilding Narrow Gage Cars

By Lucas Dreith
Repair Track Foreman, Denver & Rio Grande Western, Alamosa, Colo.

THE rebuilding of freight car equipment in a minimum number of hours per car has for some time been claiming the attention of car department officers, and good results have been obtained by using the competitive gang method. The Denver & Rio Grande Western has recently completed at its Alamosa shops 100 narrow gage box cars of 50,000 lb. capacity. The operations were divided into groups and it took nine different groups to finish one car. The men working on each group of operations were specialists on the particular repair job which they performed. The cars were all dismantled before the various operations were started and were rebuilt on an open repair track to which all material was delivered by helpers. The cars were not moved from one operation to another and no special provisions were made for additional or extra facilities.

The following table shows the various operations and the average time of completing each:

| Operation | Work performed | Man-hours per operation |
|---|---|---|
| 1 | Trucks | 3½ |
| 2 | Underframe | 16 |
| 3 | Post braces and plates | 14 |
| 4 | Decking, lining, grain strips | 7 |
| 5 | Siding and facing | 5 |
| 6 | Roof sheathing and roof | 4½ |
| 7 | Doors, safety appliances, corner irons | 16 |
| 8 | Brake rigging and air pipe work | 13½ |
| 9 | Painting and stenciling | 2¼ |
| | Total man-hours to complete one car | 81¾ |

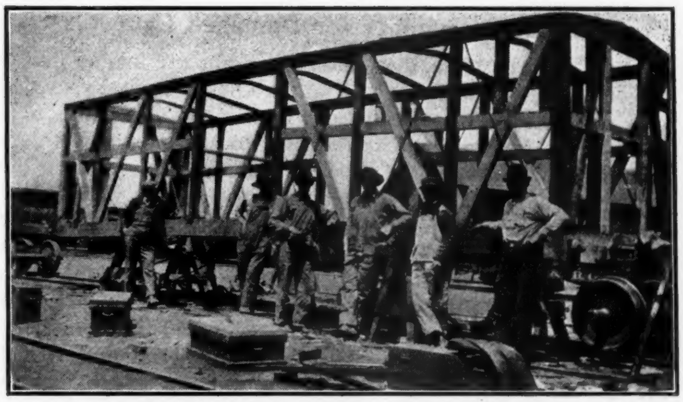
Narrow Gage Box Car Rebuilt in 81¾ Man-Hours

## Material Required for Each Car

The frame work of the car was constructed from Oregon pine and oak. Each car required the following timbers:

| No. of pieces | Name of timber | Size of each | |
|---|---|---|---|
| 2 | Side sills | 5 in. by 9 in. | |
| 2 | Center sills | 5 in. by 9 in. | (A. R. A. standard oak splice at end) |
| 2 | Intermediate sills | 4 in. by 7 in. | |
| 2 | End sills | 6 in. by 11 in. | |

The upper frame required 20 posts and 16 braces, with side plates 4 in. by 6 in., end plates 3 in. by 11 in., and seven metal roof carlings. The siding, sheathing and lining



Frame of Narrow Gage Box Car Rebuilt in 30 Man-Hours

consisted of ⅞-in. by 3¼-in. hard pine boards. The flooring was made from 1¾-in. by 7¼-in. Oregon pine. The roof and sheathing was covered with an outside metal XLA roof. Each car required 47 bolts, 16 rivets, 4,868 nails, 732 30-penny spikes and 134 screws.

THE MISSOURI-KANSAS-TEXAS so far this year has established a record of an average of 872,634 passenger car miles for every delay on account of hot boxes, compared with 465,873 passenger car miles during 1923. This mileage has been made notwithstanding the fact that the main line cars run between San Antonio and St. Louis make an average of 15,000 car miles a month or an average of about 100,000 car miles between the changing of packing and the inspection of journal bearings.

# Recent Decisions of the Arbitration Committee

*(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)*

### Failure to Stencil Air Brakes Properly

The air brakes under Mobile & Ohio coal car No. 10441 were cleaned by the Illinois Central at Burnside, Ill., January 14, 1922. The brakes were due for cleaning according to the old date stenciled on the car which was 2-28-21, Mobile & Ohio. The air brakes were again cleaned by the Chicago & North Western, June 30, 1922, on account of the triple valve being dirty and because there was no date or initials stenciled on the cylinder or auxiliary reservoir. The owner claimed that the Illinois Central had failed to apply the proper stenciling at the time it performed the work, which resulted in the brakes being cleaned a second time by the Chicago & North Western and therefore, the owner should not be penalized to the extent of refunding the $5.14 charged against the car. The Illinois Central contended that inasmuch as the Chicago & North Western repair card showed that the triple valve was dirty and needed to be cleaned, the owners should be held responsible. It also contended that the repair card did not show conclusively that this work had been performed on account of the stenciling being omitted.

It was decided by the Arbitration Committee that Interpretation 3 of Rule 60 covered the case, and that the Illinois Central should furnish offset authority for the amount of its charges for cleaning the air brakes on the car in question.—*Case No.* 1304, *Mobile & Ohio vs. Illinois Central.*

### Responsibility for Damaged Car

On August 6, 1921, the Union Oil Company loaded its car No. UOCX 627 with fuel oil at its Oleum Refinery, which was consigned to the Pratt-Low Preserving Company, Modesto, California. The car returned to the Oleum Refinery August 13, with the outlet pipe broken off. On reporting the matter to the Southern Pacific agent, instructions were issued that the car be taken to the Oakland shops for repairs. After the car arrived at the shops, the handling line ordered from the car owner an outlet pipe. This the owner was unable to supply because the car was an old one with an elliptical outlet connection. Therefore, the owner requested the Southern Pacific to cancel its requisition for the material and return the car to the Oleum shops, where the necessary repairs were made. After the work had been completed, the car owner billed the Southern Pacific for the amount of $74.63 which covered the cost of repairing and putting the car in service. An investigation by the Union Oil Company developed the fact that the car had been pulled from the siding of the Pratt-Low Company while being connected before the car was entirely unloaded. It claimed that the Southern Pacific was negligent in not ascertaining whether the car was disconnected before sending its locomotive on the private spur to pull loads or empties. The car owner further claimed that when the Southern Pacific requested that the car be sent to the Oakland shops for repairs, it admitted responsibility. The Southern Pacific in its statement admitted sending the car to the Oakland shops and placing an order with the owners for material, but maintained that these facts in themselves do not fix the responsibility on the handling line for the damage to the car. It submitted a statement tracing the movement of the car from August 6 to November 25 inclusive to subtsantiate its claim, that the car had not been damaged at Modesto.

It was decided by the Arbitration Committee that the Southern Pacific Company was responsible for the damage to the car, due to moving it before it was disconnected from the pump line, but that the charge should not exceed what it would have been for repairs in kind.—*Case No.* 1306, *Union Oil Company of California vs. Southern Pacific.*

### Specific Joint Evidence Not Conclusive as to General Conditions

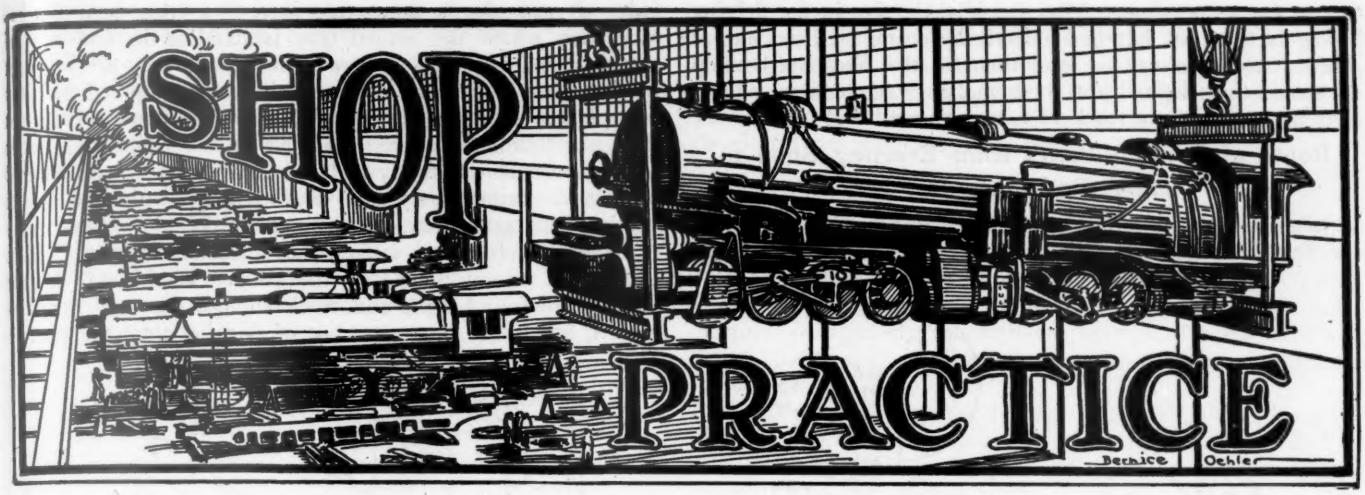
During the period of September 1, 1920, to December 31, 1921, the Texas & Pacific rendered monthly bills against the Illinois Central to cover the cost of repacking journal boxes on Illinois Central freight cars as outlined in Rule 66. Four of these bills, amounting to approximately $900 remained unpaid as the Illinois Central refused to honor them, alleging that all of the entries appearing in the bills from Gouldsboro and Westwego, La., represented charges for work that was not performed, and further demanded that the Texas & Pacific refund all money paid in previous bills covering the work from these two repair points. The Texas & Pacific claimed that it was within its rights in insisting on payment of the bills as well as in refusing to make a refund to the Illinois Central, claiming further that the bills were in accordance with A. R. A. Rule 66, and that the work was properly performed. The Illinois Central based its claims on joint evidence cards secured at New Orleans which indicated that none of the work itemized in the Texas & Pacific bills was performed at the two points in question. Repair cards from other lines were submitted showing subsequent repacking of cars billed for by the Texas & Pacific. Furthermore an investigation by the owner was said to indicate that neither enough labor nor facilities was available nor was enough oil purchased to repack the number of cars billed for.

The Arbitration Committee decided that decisions 1017, 1018, 1057, 1080, 1088, 1108, 1130, 1233 and 1289 have a general application, and that the bills should have been passed for payment subject to proper adjustment of the individual cases of wrong car reference and other admitted errors.—*Case No.* 1309, *Texas & Pacific vs. Illinois Central.*

### Responsibility for Pulling Out Draft Gear

The Canadian National in making up Extra No. 3368 at Fitzpatrick, Que., November 16, 1922, coupled onto seven or eight flat cars, and when moving out of the yard, the coupler and draft gear on the west end of Temiskaming & Northern Ontario car No. 100,041, pulled out, which it is claimed by the handling road, resulted in damaging the end sills and forcing out the side sills. The Canadian National disclaimed responsibility for the defects and reported the car to the owners under Rule 120 on December 1, 1922, stating that neither this nor any other car was derailed, cornered, side-swiped or subjected to any other condition prescribed in the A. R. A. rules as handling line's responsibility. The owner refused to agree with the handling line, basing its claim on the fact that the throttle of the switching engine would, at irregular intervals, fly open unexpectedly which resulted in irregular switching.

The Arbitration Committee decided that there was no conclusive evidence of the car being subjected to any unfair conditions as covered by Rule 32, and therefore, the damage of the car was at owner's responsibility.—*Case No.* 1311, *Canada National vs. Temiskaming & Northern Ontario.*




# Reducing the Time of Handling Driving Boxes*

## Practical Fixtures, Jigs and Tools Devised to Save Time and Labor—Grouping of Machinery Important Factor

By E. Marx
General Foreman, Winona Shops, Chicago & North Western

THERE are five principal factors to be considered in the repairs to driving boxes.

*First*—A good organization.

*Second*—All lost motion in conveying work from one machine to another or from one department to another should be eliminated.

*Third*—The proper speed and feed should be carefully determined for each machine.

*Fourth*—The use of special tools and jigs should be worked out to the best advantage.

*Fifth*—Grouping of machinery and crane facilities is considered one of the most important factors in the handling of driving box work.

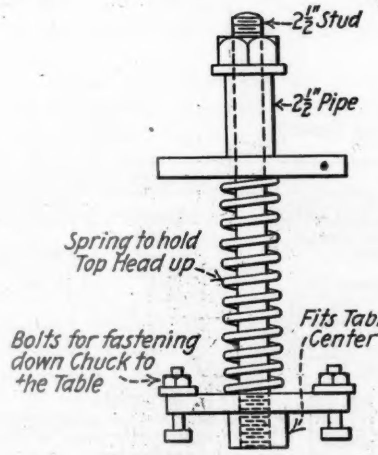



Fig. 1—Chuck for Clamping Crown Brasses on the Boring Mill While Grooving Them for Shoulders

The first step is to perfect your organization. Get good men for this class of work and keep them interested in it. Only when you have done this will you secure satisfactory results. A system should be established for handling the work from one machine to another. Keep regular men on the machines as much as is possible and always have one or two other men trained to step in and take the machines in case the necessity arises. If a regular man cannot be kept at a machine continuously, at any rate use the same man on it so that he becomes proficient at that particular class of work.

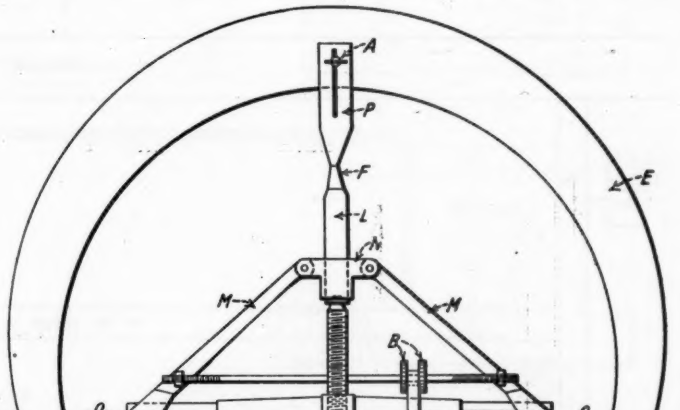



Fig. 2—Caliper and Gage for Laying Out the Shoulder Pit on the Driving Box Brasses

The principal item taken into consideration in the layout at Winona Shops is the grouping of machines and crane facilities. The crane facilities make the handling of work convenient and extremely expeditious, eliminating all truck-

* Selected as the second best paper submitted in the driving box competition which was announced in the February *Railway Mechanical Engineer*. The paper awarded the prize was published in the September issue of this magazine.

ing as far as possible. After the boxes arrive in the driving box gang they are handled entirely by crane facilities except when it is necessary to send them to the blacksmith shop or some other department for some unusual repairs. Then they are moved on a truck or a two-wheeled wagon.

### Route of Driving Boxes from Erecting Shop to Box Gang

When the wheels are removed from under the locomotives the boxes are taken from the journals and the grease or oil

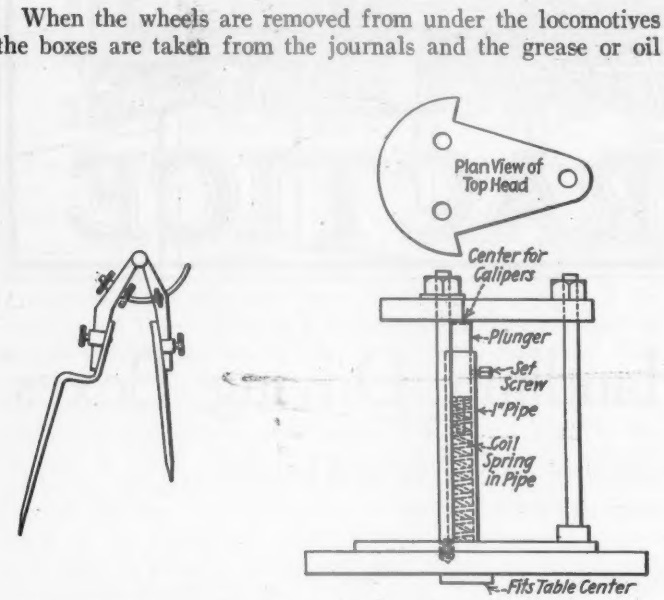



**Fig. 3—Chuck for Clamping Brass on the Slotter and Offset Calipers Made to Clear the Bolt and Nuts of the Chuck**

waste removed from the cellars. The waste is sent to the renovating plant and the grease is placed in carbide cans. It is used over again on switch engines and also as a filler on road engines in the bottom of the cellars. On top of this, next to the journal, is placed about an inch of new grease. By this time the engine has been removed from the side. It will also be noted that there is a crane near the lye vat, with which the loaded tray is handled in and out of the vat. After the boxes have been cleaned they are brought in over the same route to the driving box gang, where they are placed near the slotter and planer. From this point they are handled entirely with air hoists suspended from overhead cranes or trolley rails in their course to the several machines. Immediately after the boxes are unloaded at the driving box gang they are inspected. If new brasses are required the foreman orders the material from the store house and has it placed at the proper machines. If the brasses are found tight and thick enough they are not disturbed, but if the boxes are out of parallel they are put on

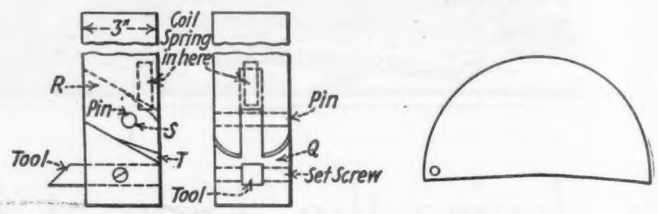
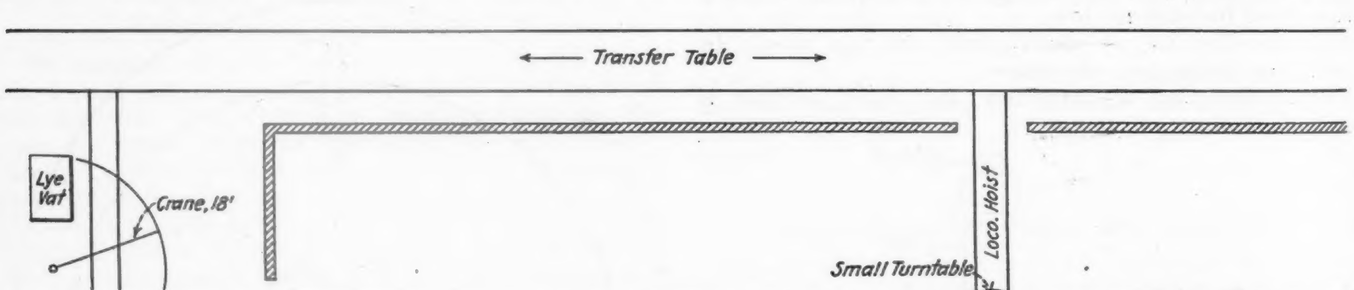



**Fig. 4—Slotter Tool Holder and Template Used in Centering the Brasses on the Slotter Table**

the planer for machining. The cellars are refitted in the meantime.

### Applying New Brasses

If it is found necessary to apply a full set of new driving box brasses, the babbitt is knocked off of the boxes and they are then placed on the hydraulic press where the brasses are removed. The new brasses are placed on the boring mill and grooved for the shoulder. A special chuck is used to facilitate this operation. The brasses are then placed at the slotter where they are grooved for the box fit, after which they are ready to be pressed in. Special tools are provided and used by the man on the slotter. As soon as the brasses have been pressed in the cellars are fitted to the boxes and




**Shop Layout of the Driving Box Department Showing Location of Machines and Route the Boxes Travel**

locomotive hoist pit to its assigned stall. A wagon with a large tray is pushed in the shop and the boxes with other parts are loaded onto it and conveyed, via the transfer table, to the lye vat, which is located near one end of the shop, as will be seen by referring to the illustration showing the layout. This work is done by a labor gang on the erecting

if found to be loose in the fit, a small liner, from 1/16 in. to 3/16 in. thick, depending on the amount of play, and 2 in. wide is riveted or tap screwed to the side of the cellar. A few strokes with a square file will then insure a good fit. Time is well spent in the close fitting of cellars.

During the time the brasses and cellars are being fitted

the saddle pockets are squared up. A small piece of front end wire netting, 1½ in. by 4 in., is electrically welded to the hub face of each box for holding on the babbitt. After the brasses and cellars are fitted it is not necessary to hold up the shoe and wedge man in waiting for the boxes to be planed in order that he may get the box sizes for laying out the shoes and wedges, as they can be taken at once, and if necessary, an allowance made for planing off the least possible amount of material. After the boxes are planed they go to the babbitt fire to be babbitted, and then they are ready for boring. A 42-in. double head Niles-Bement-Pond electrically driven boring mill with a table speed of 65 r.p.m.

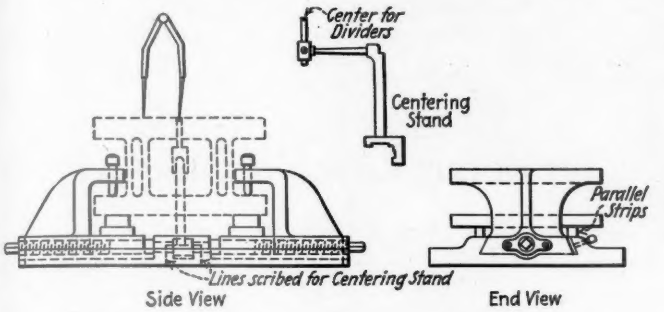



Fig. 5—Boring Mill Chuck for Holding Driving Boxes

is used for this work. This machine is fitted up with a special chuck, the jaws of which engage the parallel shoe and wedge face and clamp the box centrally on the mill. While the box is being bored for the journal fit the lateral is faced simultaneously with a tool in the other head of the boring mill.

## Fitting Boxes on the Journals

The boxes are next taken to the locomotive wheels to be fitted to the journals. Suitable cranes or air hoists should be installed to handle the wheels where this work is done. To handle boxes onto the journals two benches, each of different height, to suit the different sizes of drivers, should be used, also a roller or short piece of pipe, and a small bar. In fitting driving boxes to the journals the foreman in charge should see to it that the men are properly instructed in this work. The boxes should not be fitted too large for the journal and the sides should not be chipped or filed away so as to bring the center line of the brass above the center line of the journal.

In removing the cellars from the boxes they invariably are found to be tight and cannot be knocked out of the box with the use of a flatter and sledge. A very good device in a case of this kind is to use a cross bar long enough to pass through the wheel spokes. For the larger cellars a U-shaped forging of sufficient depth and width and a short jack can be used to advantage. This arrangement will readily force a cellar from any box.

Our road has a large number of locomotives equipped with the Markle removable hub plates. This improvement is a great time saver, making a small job out of the task of taking up lateral. To take up lateral with this device the old plate is removed and rebabbitted, or replaced with one kept on hand in the enginehouse. Standard jigs have been made for the various styles of boxes and the lateral plates are all planed to the standard box they are intended for in order that they may be interchangeable.

We also have a number of locomotives equipped with the Markle removable brass. This brass, permitting its removal without the usual dropping of the wheels, makes it a big time saver. The brass is held in place by a taper key, which is inserted by hand and driven home the last 1½-in. All parts of the box are machined to special jigs, which insure a perfect interchange and extreme accuracy in maintaining standard sizes. Aside from the removable features, there is the use of the key for tightening the brass in the box. Boxes equipped with this brass are also equipped with a two piece removable hub plate. With this arrangement the lateral can be taken up readily. A special jig has been developed for machining this brass.

## Description of the Tools

A chuck for clamping a brass on the boring mill while grooving it for the shoulder is shown in Fig. 1. The brass is held between the top and the bottom heads by screwing down the nut at the top. Different lengths of 2½-in. pipe nipples are used for the different lengths of brass, but only when a great variation in lengths of the brasses is encountered.

A caliper and gage for laying out the shoulder fit on the driving box brasses preparatory to slotting is shown in Fig. 2. This is flexible and capable of three independent adjustments. The two contact points *C* are 4 in. long. The stem *L* is ½ in. in diameter, to which is soldered a contact bar *F*. It is also 4 in. long, and bears against the top of the brass fit in the box. A 1/16-in. key-way is cut the entire length of the bar *L* and a feather with gib heads is fitted in the hub portion of *N* to keep the contact bar in its proper position. The calipers are adjusted by means of the thumb wheels *B* and the hand wheel *D*. When the calipers are inserted in the box and adjusted to size, the gage *E*, which is shown superimposed, is set to the calipers at the three points, *C*, *C*, and *F*, the sliding clips *P* being adjusted to the bevel of the toe of the brass and clamped by the thumb screws *A*. The gage *E* is then removed and laid on the brass and the necessary lines scribed. The offset dividers,

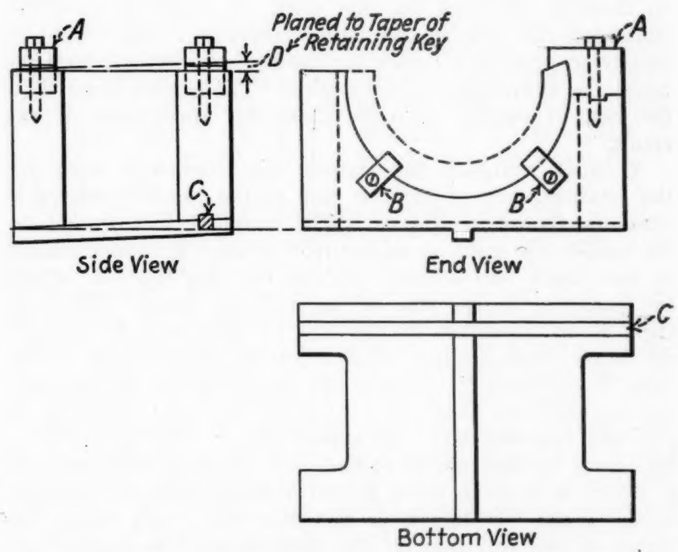



Fig. 6—Chuck for Holding the Markle Removable Crown Brasses When Cutting the Taper for the Retaining Key

shown in Fig. 3 are used for scribing the outer contour to which the brass is to be slotted.

A very simple chuck for clamping down the brass on the slotter table is shown in Fig. 3. The 1-in. pipe with the spring and plunger merely serves the purpose of holding the top head up when not in use. It also serves as a center for the dividers in scribing the brass.

Fig. 4 shows a slotter tool post which is made in two parts, the upper piece *R* having a slot in its lower end, into which fits a tongue on the lower piece *Q*. It is pivoted about the pin *S*. The shoulder of the slot is slightly relieved at *T* to allow the tool to swing back on the return or upward stroke.

A sheet steel template, shown in Fig. 4, is used in centering

the brass on the slotter table. The slotter man has an assortment of these made to conform with the various sizes of brasses as shown on the blue prints. He takes one of the templates and tries it in the box to see how much it is spread. He then lays the template on the rough brass and scribes around it, allowing, by eye, for the amount the box was found to be spread. This operation merely serves to facilitate the centering and setting up of the work. He now calipers the box, and finishes the brass with one cut. While the cut is being taken he takes the inside calipers, and inserts them in the box and adjusts them so they can just be slid up and down. The brass fit in the box always tapers slightly, because the tool crowds away from the work. By sliding the calipers up and down the largest end is found and the calipers adjusted. When the clips of the gage are adjusted they give the angle of the retaining shoulders, which may be transferred directly to the finished brass and scribed thereon.

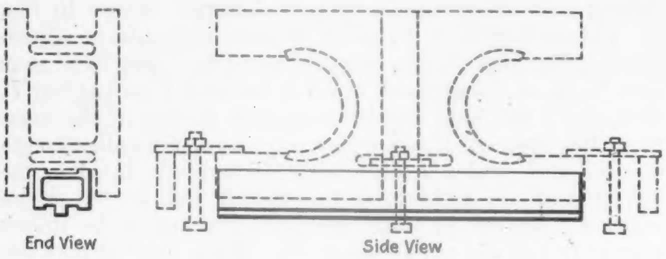



Fig. 7—Parallels for Planing Driving Boxes

A boring mill chuck for boring driving boxes is illustrated in Fig. 5. It will be noted that it centers the box one way so there is no work on that part. A stand is used for centering the box in the other direction. The stand is merely to provide a center for the dividers while trying the brass for the center at the crown. The dotted lines show the box in outline to make clear the application of the chuck.

A chuck designed for planing the lengthwise taper for the retaining key of the one side of the Markle removable brass is shown in Fig. 6. The brass is first slotted on the outside the same as an ordinary brass. It is then placed in the chuck and secured fast by the two clips *A*, which are made to fit the side of an ordinary brass. The two clips *B* are provided on the end of the chuck to prevent the brass from sliding when a cut is being taken. The taper is obtained by slotting the chuck on the bottom near the one end and inserting a strip of the right thickness to give the required taper, as shown at *C*. The one side of the chuck is also planed to the same taper as indication at *D* which is done in order not to interfere with the planing of the brass. If this were not done the chuck would be higher at one end than at the other when it was tilted on the strip *C*. As many of these chucks are needed as there are sizes of brasses, but at the present time a study is being made to see if we can use one chuck for all sizes, either by using liners or in some other way, possibly by adjustment.

To save the time spent in setting up the driving boxes on the planer platen preparatory to planing, we have had some castings made as shown in Fig. 7, 38 in. long, which will hold two boxes. They are planed small enough so that the shoe and wedge fit of the smallest box will straddle them without resting on the fillets. These castings are nothing more than parallels. Several of them are provided so that as many boxes may be planed as the planer platen will accommodate. When either new or old boxes are to be planed we set them up in two rows on the platen and use both planer heads. Each head is provided with a tool post that takes two cutting tools. In this way we plane four flange surfaces of the shoe and wedge fit simultaneously. The planer platen travels at the rate of 45 ft. per minute cutting and 150 ft. on the return stroke.

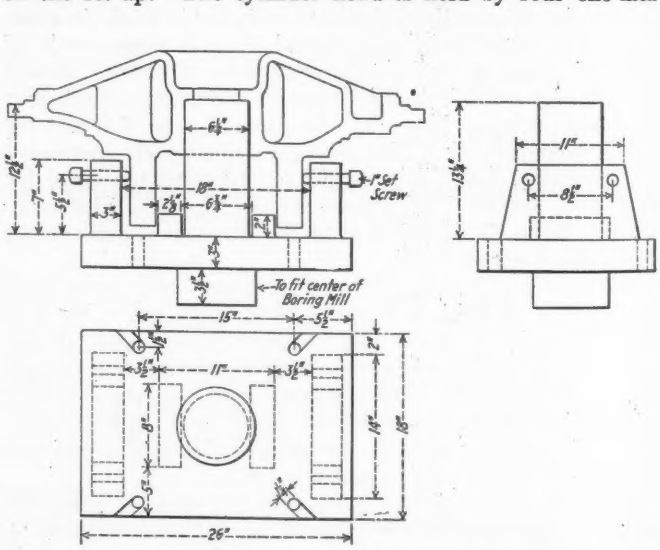
We have two steady men working on driving boxes. One man who slots the brasses, presses them in the boxes and does all the other work pertaining thereto. He also inspects the boxes when they come from the lye vat. The other man fits up the cellars and saddles and any other work in connection with these parts. He knocks off the old babbitt from the boxes and presses out old brasses, refits hub liners, etc. The planer and boring mill men do only the necessary machining and all other machine work about the shop. With this organization we have turned out as high as 1,100 boxes per year. Some months we turned out 124 boxes per 25-day month, which means an average of about five boxes per eight-hour day.

# Jig for Boring Low Pressure Cylinder Heads

By J. H. Hahn

Machine Shop Foreman, Norfolk & Western, Portsmouth Shops, Ohio

The illustration shows a fixture for holding low pressure cylinder heads for Mallet engines, in a boring mill while being finished on the face and in the recess that takes the boss on the low pressure piston centers. The general practice is to take about 12 of these heads, bore and face them for the stuffing box glands and then put this fixture on the boring mill. It is centered in the bushing in the center of the boring mill table, and a guide on the fixture which is finished to fit the gland recess centers the heads, so that no time is lost on the set-up. The cylinder head is held by four one-inch set screws which are placed at an angle of about 15 deg. so that when they are tightened they will pull the head down solid.




One Hour's Time Can Be Saved by Using This Fixture When Boring Back Low Pressure Cylinder Heads

As the recess in these heads has to be finished, it is impossible to use a fixture of the usual design with a clamp on the top. This fixture has saved 45 minutes to 1½ hours on the total time for machining one of these heads. A copper joint is also put on the heads and faced while on the fixture.

By a slight change in design, this fixture can be used for any type of back cylinder heads.

# Additional Papers Discussed by Tool Foremen

## Maintenance of Pneumatic Tools and Wrench Standards Were Considered at Chicago Convention

*Dinner of the American Railway Tool Foremen's Association, Held During the Twelfth Annual Convention, at the Hotel Sherman, Chicago.*

A PARTIAL report of the twelfth annual convention of the American Railway Tool Foremen's Association, recently held in Chicago, was given in the October *Railway Mechanical Engineer* beginning on page 621. One of the subjects discussed, and not included in the initial convention report, was that of the proper methods of repairing and maintaining pneumatic tools, than which almost no problem confronting tool foremen is more important. The subject of standard open end wrenches for locomotive shop and enginehouse use was also discussed and certain standards agreed upon.

## Repair and Maintenance of Pneumatic Tools

By E. A. Hildebrandt

**Tool Foreman, Cleveland, Cincinnati, Chicago & St. Louis, Beach Grove, Ind.**

Air motors are one of the most essential, as well as one of the most abused machines in railroad shops. They are used under all sorts of conditions, in all kinds of weather. They are thrown on the ground, allowed to get dirty, connected to air hose that has not been first blown out, thoughtlessly struck with hammers, and a great many times used with tools that are too dull to cut freely.

Rusty air lines are one of the worst conditions to contend with, and unless operators blow out the air lines before connecting with motors, damage may be done which will greatly impair the efficiency of the machines. Rust in the valves of the motors causes them to score which not only cuts down the power but also runs up the repair expense. This can be partially eliminated by making sure that the air strainer is in every live air handle and that when strainers need cleaning they are cleaned and replaced and not punched out as so often happens.

When cylinders are dented or worn due to causes as outlined, it is necessary that the dents be scraped or the cylinders reamed and oversize pistons applied. When a cylinder is worn to such an extent that it cannot be reamed for a standard oversize piston, supplied by the manufacturer, the body may be reclaimed in the following manner:

The cylinders are bored out 1/8 in. larger than the original size, up to the lower edge of the air port. This operation is done by clamping the body to an angle plate and in turn to the face plate of the lathe; the body is then bored from the inside of the cylinder up to the lower edge of the air port. A bushing made of low carbon machine steel is then passed through the side plate opening and pulled in place with a bolt and washers made for the purpose. This work is all done with the body still attached to the face plate of the lathe. The bushing is now bored out to fit a new standard size piston.

The cost of boring cylinders and making and applying four bushings will not exceed $4.00. This is very low compared to the cost of a new body which would otherwise have to be applied. This method of reclaiming was tried about three years ago and proved successful; the motor repaired then is still giving first class service. It is seldom that all four cylinders have to be bushed, and accordingly the cost of reclaiming is in proportion to the number bushed.

After the motor is assembled it is run slowly without load for approximately two hours so that the pistons will wear in perfectly. It is then tried out under load for about one-half hour, at all times being well lubricated with a mixture of Keystone No. 2 grease and valve oil proportioned 10 lb. of grease to 1 1/2 gal. of oil. With this mixture it has been found that the grease will reach all parts of the motor and will not lump up or stick to the walls of the cylinder. This method of bushing cylinders can be applied to corner motors as well as to the four-cylinder type motors. Several corner motors have been repaired in this manner and are giving satisfactory service.

Oversize valves can now be obtained which eliminates the application of new valve bushings. When a valve bushing is scored, all that is necessary is to ream it to the size of the oversize valve, thereby reclaiming the bushing and eliminating the tedious job of setting the bushings correctly. It also saves the cost of a new valve bushing and labor to apply it.

It has been claimed that motors with oversize valves will not have as much power as motors with standard valves. This condition has not been experienced at Beach Grove. Every motor repaired is tried out on a prony brake testing

machine and a record is kept of its pulling capacity. This record is compared with the records of all new motors put in service.

One of the numerous minor troubles is the sticking of valves in live air handles due largely to moisture in the air. When stuck, workmen will sometimes use a hammer or pipe wrench to loosen them, sometimes doing more damage than good. When handles get in bad condition they should immediately be attended to, for a leaky handle is a loss to the company. It costs considerable to produce compressed air, and all air leaks are a loss of energy, which means increased expense.

It has been found that supplying each individual gang on boiler work with motors best suited for their work, increases production, and the motors are better taken care of, because each gang is charged with the motors and held responsible for them.

On the erecting floor each gang foreman is assigned enough motors for the class of work he supervises and he is held responsible for them and sees that they are used in the proper manner. Twice a week a man is sent out to oil motors and check up and report motors that are not in good condition. These are sent to the toolroom for repairs as soon as reported. The motors out in the shop are oiled with a mixture of valve oil and motor oil, mixed 4 gal. of valve oil to 1/2 gal. of motor oil.

Worn spindles in air motors should be replaced with new, as it is not only injurious to the motor when a drill jumps out of the tang slot, but it also often ruins the tang on the drill. Workmen should be instructed to use the extractor pins in air motors for removing tools and not be allowed to strike drills or reamers with a hammer to get them out of the socket.

### Air Hammers

Air hammers, like air motors, must be kept in first class repair so that they may deliver full power to the work. Here too, we must get 100 per cent repairs at a minimum repair cost, which can be done by reclaiming some of the different parts that go to build up a hammer.

Valve blocks are reclaimed in the following manner: The valve block is closed .012 in. by pressing it through a hardened steel block. It is then reamed to the standard size and a new valve applied. The life of a reclaimed block with new valve is equal to a new valve and block. The cost of reclaiming a valve block is $.50 plus the cost of a new valve. When the block is again worn large, it is reclaimed by reaming it oversize .002, .004 or .006 in., whichever the case may be, and an oversize valve is applied. These oversize valves are now furnished by all pneumatic tool manufacturers.

In this manner a valve block can be reclaimed five times and approximately 3 1/2 years' service obtained from the original block and five new valves.

The closed-in valve blocks are first reamed with a roughing reamer and finished with a finishing reamer, using raw linseed oil as a lubricant. This gives the valve a smooth finish equal to the polished surface made by the action of the old valve. In reclaiming handles it is often necessary to apply a larger hose connection because the original threads are stripped. To repair a handle of this kind quickly, it is necessary to have in stock connections with standard 1/2-in. pipe threads for the hose connection end and threaded on the other end to fit the handle, which has been tapped with an oversize pipe tap. The connections are also fitted with a strainer.

The application of a connection of this kind also standardizes the hose connections in the shop. Sometimes the handle wall is too thin to re-tap. These have been successfully repaired by brazing the connection in the handle. Handles fitted with piston throttle valves will stick when they become rusty from moisture in the air, and if they are not used every day the valve will become pitted. When cleaned or polished they will leak. Leaks are expensive, so it is best to get the full benefit of the air pressure by reaming the valve bushing and applying an oversize throttle valve to stop the leak. Lubricate the hammer before putting away until the next time used.

A good many hammers have been equipped with ball throttle valves and we find them far superior to the piston throttle valve; they are easy to apply, low in upkeep cost and have no air leaks.

Hammer barrels are good for about one year when used on steel car work, the life of the barrel being greatly reduced owing to the fact that some operators will grind the piston to about 1 1/8 in. long. Short plungers cause the barrel to wear large at the snap end where they strike the rivet set which causes the hammer to lose power. Plungers shorter than 1 3/4 in. should not be used.

On boiler and machinist work, longer plungers are used, which greatly increases the life of the barrel. Barrels that are worn are closed up approximately .020 in. by heating and swedging in dies made for this purpose. They are then reamed out in the lathe; the barrel is held stationary in a chuck fitted to the crossfeed of the lathe; the reamer is held in the lathe chuck and linseed oil is used as a lubricant. A roughing reamer and finishing reamer are used. The barrel is then chucked in the lathe and bored for the rivet snap. The valve block seat is reamed on the bench with a special reamer which is held in line by a cap which screws on the hammer barrel.

Workmen that use air hammers regularly are supplied with them and retain them as long as they are on work that requires the use of a hammer. When their work is changed, or they leave the service of the company, they must turn them in before they can get a release. All hammers are lubricated and tested in all positions on a large steel block which is kept in the toolroom for this purpose.

## Open End Wrenches

At the 1923 convention E. J. McKernan, supervisor of tools of the Atchison, Topeka & Santa Fe at Topeka, Kans., was appointed a special committee of one to investigate and report on the possibility of standardizing and getting some reliable firm to manufacture wrenches for locomotive shop and enginehouse use. After considerable experiment a

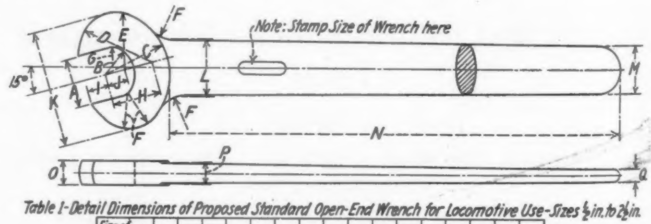



*Table 1—Detail Dimensions of Proposed Standard Open-End Wrench for Locomotive Use—Sizes 1/2 in. to 2 1/2 in.*

| Size of Nut | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2 in. | 31/32 | 9/16 | 1 5/16 | 1 5/16 | 1 3/16 | 3/8 | 1/4 | 11/16 | 9/16 | 9/32 | 2 3/8 | 1 1/4 | 1 | 10 | 1/2 | 3/8 | 1/4 |
| 5/8 in. | 1 1/8 | 21/32 | 1 1/2 | 1 11/16 | 1 3/8 | 1/2 | 5/16 | 1 1/16 | 19/32 | 7/16 | 2 3/4 | 1 3/8 | 1 1/8 | 11 | 5/8 | 1/2 | 3/8 |
| 3/4 in. | 1 5/16 | 25/32 | 1 7/8 | 1 31/32 | 1 5/8 | 7/8 | 5/16 | 1 1/4 | 19/32 | 1/2 | 3 1/4 | 1 1/2 | 1 1/4 | 12 | 3/4 | 5/8 | 3/8 |
| 7/8 in. | 1 1/2 | 7/8 | 2 | 2 5/16 | 1 13/16 | 1 | 5/16 | 1 1/2 | 11/16 | 5/8 | 3 5/8 | 1 3/4 | 1 1/2 | 14 | 3/4 | 5/8 | 3/8 |
| 1 in. | 1 11/16 | 1 | 2 3/16 | 2 11/16 | 2 | 1 1/8 | 3/8 | 1 13/16 | 3/4 | 11/16 | 4 | 1 7/8 | 1 5/8 | 15 | 7/8 | 3/4 | 1/2 |
| 1 1/8 in. | 1 15/16 | 1 1/8 | 2 1/2 | 3 | 2 1/4 | 1 1/4 | 3/8 | 2 | 13/16 | 3/4 | 4 1/2 | 2 1/8 | 1 3/4 | 16 | 1 | 3/4 | 1/2 |
| 1 1/4 in. | 2 1/16 | 1 1/4 | 2 5/8 | 3 3/8 | 2 5/16 | 1 1/2 | 3/8 | 2 | 7/8 | 13/16 | 4 5/8 | 2 1/4 | 1 3/4 | 18 | 1 | 3/4 | 1/2 |
| 1 3/8 in. | 2 1/4 | 1 5/16 | 2 11/16 | 3 5/8 | 2 7/16 | 1 5/8 | 1/2 | 2 1/2 | 15/16 | 7/8 | 4 7/8 | 2 3/8 | 1 3/4 | 19 | 1 1/8 | 7/8 | 5/8 |
| 1 1/2 in. | 2 7/16 | 1 7/16 | 2 7/8 | 4 | 2 5/8 | 1 3/4 | 1/2 | 2 7/8 | 15/16 | 7/8 | 5 1/4 | 2 1/2 | 1 3/4 | 20 | 1 1/8 | 7/8 | 5/8 |
| 1 5/8 in. | 2 5/8 | 1 1/2 | 3 1/16 | 4 1/4 | 2 7/8 | 1 7/8 | 1/2 | 3 | 1 | 15/16 | 5 3/4 | 2 1/2 | 1 3/4 | 21 | 1 1/4 | 1 | 5/8 |
| 1 3/4 in. | 2 13/16 | 1 5/8 | 3 5/16 | 4 3/4 | 3 | 2 | 1/2 | 3 1/2 | 1 1/16 | 1 | 6 | 2 3/4 | 2 | 22 | 1 1/4 | 1 | 5/8 |
| 2 in. | 3 1/4 | 1 7/8 | 3 13/16 | 5 5/8 | 3 1/2 | 2 1/8 | 1/2 | 4 1/4 | 1 1/4 | 1 1/4 | 7 | 3 | 2 | 23 | 1 1/4 | 1 | 5/8 |
| 2 1/4 in. | 3 9/16 | 2 1/16 | 4 3/16 | 6 | 3 5/8 | 2 1/4 | 5/8 | 4 1/2 | 1 1/4 | 1 3/16 | 7 1/4 | 3 1/4 | 2 1/4 | 24 | 1 1/4 | 1 | 5/8 |
| 2 1/2 in. | 3 15/16 | 2 1/4 | 4 5/8 | 7 | 4 | 2 1/2 | 5/8 | 5 5/16 | 1 3/8 | 1 3/8 | 8 | 3 1/2 | 2 1/4 | 25 | 1 1/2 | 1 | 5/8 |

**Proposed Standard Open-End Wrench for Use in Locomotive Shops and Enginehouses**

wrench was developed as shown in one of the drawings, being made in accordance with the detailed dimensions shown in Table I. This is strictly a locomotive wrench for back shop and enginehouse use. The wrench is sufficiently rugged to be used with a pipe or flue extension on the handle and will stand abuse with a sledge hammer. The width of the jaws is such that the wrench will fit a standard locomotive nut but not a finished nut.

This wrench is semi-finished, being cut with the acetylene torch out of a piece of soft steel of .20 to .30 carbon. The burrs are ground off and the wrench finished. The head of the wrench is case hardened just enough to toughen it.

Mr. McKernan stated that a company has been found which is willing to make wrenches in accordance with these specifications, giving a guarantee against defects and charging a range of prices from 90 cents for the smallest to $4.50 for the largest wrench. The Association voted to adopt this wrench as standard and went on record to the effect that considerable economy can be realized in purchasing wrenches instead of making them as they are being made today with so many failing to stand up under severe service.

# Jigs and Fixtures

By F. U. Baker

Tool Foreman, Baltimore & Ohio, Pittsburgh, Pa.

The cost of repairing cars and locomotives is determined to a considerable extent by the number and quality of labor-saving jigs and devices used in railroad shops. The following jigs or fixtures were developed in the Glenwood shops of the Baltimore & Ohio and have given good satisfaction in service.

## Truing Trunion Bushings

A tool for truing the trunion bushings on link plates, shown in Fig. 1, can be used in a drill press with a considerable saving of time over that required when performing this operation on a boring mill. The turning of eccentric crank arms is another operation which can be profitably per-

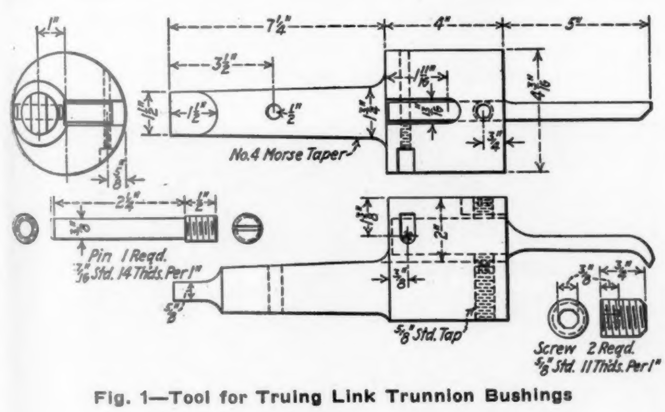



Fig. 1—Tool for Truing Link Trunnion Bushings

formed by the use of this tool, owing to the fact that the entire arm does not have to be revolved, which would require placing it on a boring mill table, or large lathe face plate.

It will be noticed that the cutting tool extends into the offset main body of the tool which is provided with a No. 4 Morse taper shank to fit in the drill press spindle. The cutter is pivoted at the upper end on a 3/8-in. pin, and 1/2-in. adjustment of the cutting point is obtained by means of the two set screws shown. This will allow proper adjustment of the cutting point for bushings of different size.

## Replacing Locomotive Springs

The details of a device, recently designed for removing or replacing locomotive driver and trailer springs, are shown in Fig. 2, representing an improvement over the former methods of performing this operation. An overhead crane was formerly employed, necessitating considerable manual effort in guiding the springs into place on account of interference with the running board or cab.

Referring to the illustration, the device consists of a bar 7 ft. 11 in. long with a fork end, to each prong of which is connected a 3/8-in. chain, 36 in. long, fastened with I-bolts as shown. The prongs or fork end of this bar is placed on

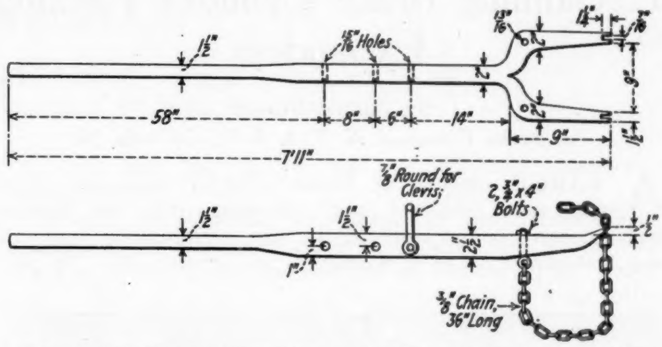



Fig. 2—Device for Removing or Applying Heavy Locomotive Springs

top of the spring, the two chains being brought under the spring and fastened in the ends of the prongs, thus forming a sling in which the spring rests. The overhead crane hook is fastened in the clevis in the bar and raises the spring, while a workman handles the opposite end, guiding the spring into place. The clevis is adjustable to three positions, all of which are off center thus enabling one man to balance a spring easily.

By using this device, springs can be handled either for removal or replacement in a short time and with relatively

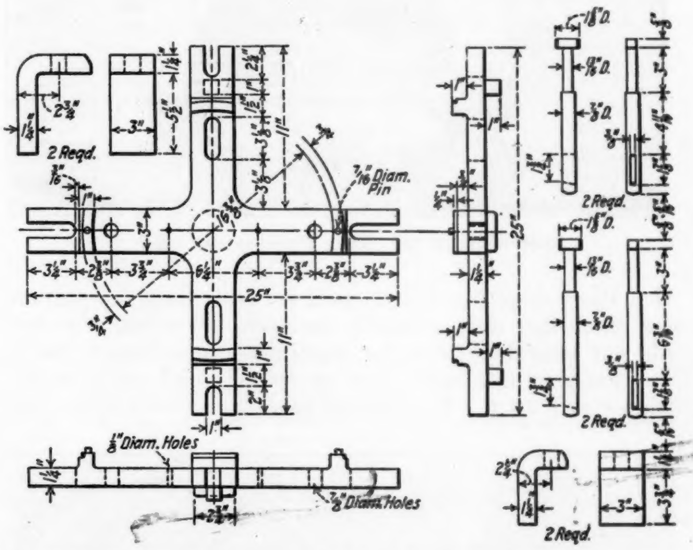



Fig. 3—Jig for Turning and Boring Eccentric Strap Bushings

little physical effort. The overhead crane chain does not come into contact with any other part of the locomotive. The device has been used for handling driver brake cylinders, but in this case the chains form a sling and the cylinder is allowed to rest on top of the prongs while the chains are brought over the top and fastened.

## Machining Eccentric Strap Bushings

The machining of eccentric strap bushings previous to the development of the jig shown in Fig. 3 was performed on an engine lathe requiring three operations as follows: Bushings

chucked for turning one-half of the outside; bushings re-chucked for turning the remainder of the outside; bushing re-chucked for boring the inside complete.

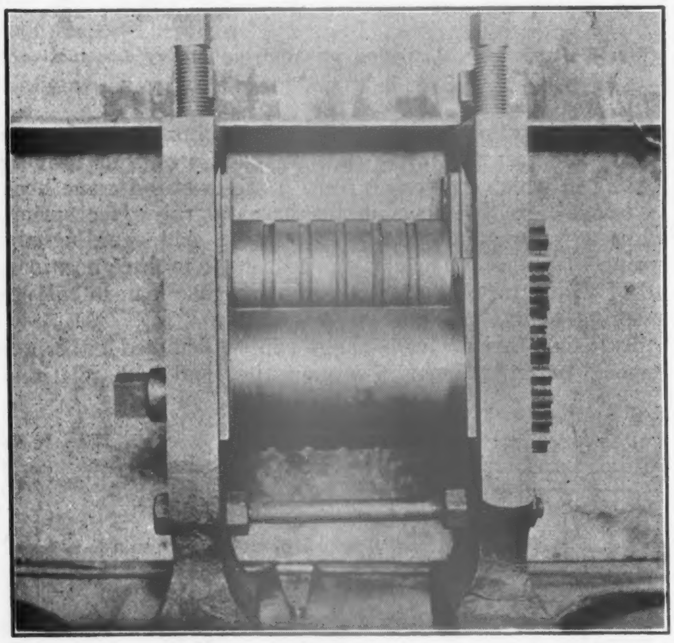
By adopting the jig illustrated it is now possible to perform this work on a small boring mill and eliminate the re-chucking operation. The work is now handled to completion on the boring mill.

# Reclaiming Brake Cylinder Packing Expanders

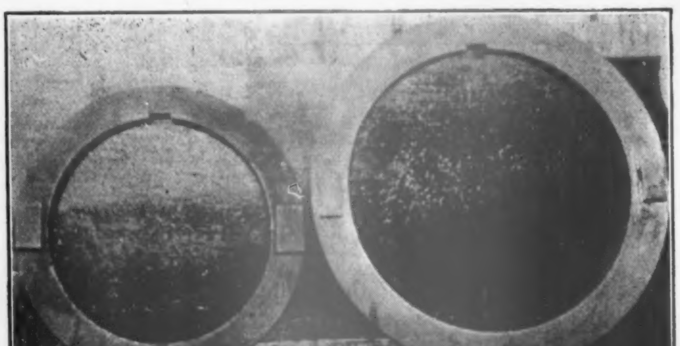
By Archie Skinner

Air Brake Foreman, A. T. & S. F., Corwith, Ill.

A LARGE amount of brake cylinder expander rings that were distorted and otherwise unfit for further service were being received in the reclamation yard of the Atchison, Topeka & Santa Fe, at Corwith, Ill. To prevent these rings from being used for other than the purpose for which they were originally designed, the writer, after trying out several methods for reclaiming them, found that it was too slow to anneal, true up on the anvil and then re-temper each ring. This method involved so much labor and expense that its continuance was out of the question. Finally a set of rolls was made similar in design to those used in a tin shop. These rolls were made of tool steel so as to prevent burring up the grooves when the rings were being passed through.

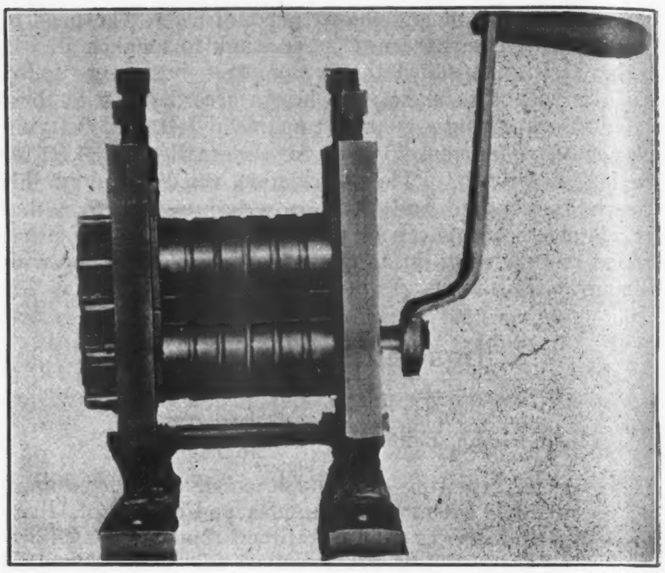


Rear View of the Rolls Showing the Idler



Checking Blocks Used to Determine Whether Ring Conforms to Standard Dimensions

A front view of the rolls is shown in one of the illustrations. The three grooves on the left are for the 8-in. rings and the two on the right are for the 12-in., 14-in., 16-in. and 18-in. rings. Screws for adjusting the rolls are located on the top of the frame. The rings are passed through the grooves of the two front rolls and over an idler in the rear. Adjustments of the three rolls may be made so as to give the rings the correct set. Referring to the illustration of the two views of an expander, the ring on the left, which has not been reclaimed, has a large opening at the top and it is also out of round. The ring on the right has been rolled so that the opening at the top is standard and the ring is perfectly round.



Front View of the Rolls

Checking blocks are also provided for this work, which are used to determine if the ring conforms to Westinghouse standard dimensions. These checking blocks can be made either in the shop or purchased from the Westinghouse Air Brake Company. They can readily be made in the shop as they require no complicated machinery.


An Example of the Kind of Work Done by This Machine

A record of the first day's run showed that there was a total of 270, 10-in. rings and 255 8-in. rings reclaimed. Since the first trial we have reclaimed 700 rings at a saving of at least half of what it would cost to buy these rings new from the manufacturer. A recapitulation of the savings ef-

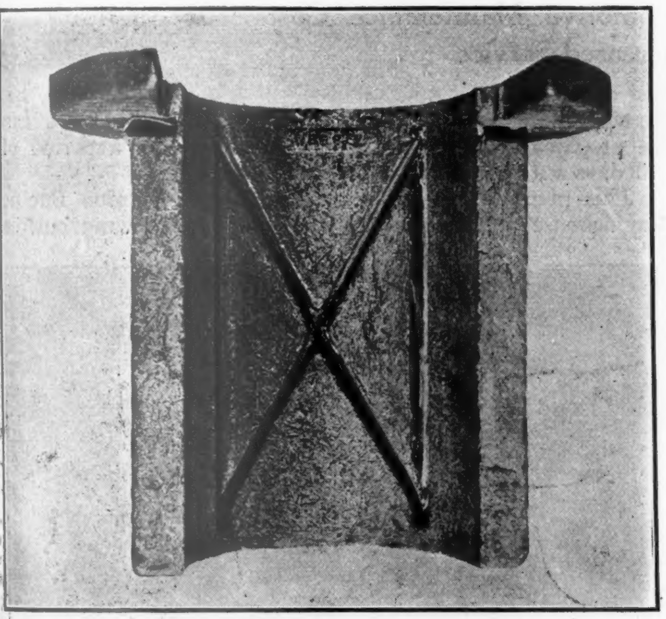
fected from the first day's trial showed that the cost to reclaim 270 10-in. rings at nine cents each was $6.28, thereby saving $18.02. The cost to reclaim 255 8-in. rings was also $6.28, which also effected the total saving of $14.12. The rolls are operated by hand power; they can be used anywhere.

# One Piece Crown Brasses Eliminate Waste

## Grease Grooves and Flange Cast on the Brass—Net Saving of $1.50 Per Box Obtained

By Millard F. Cox
Assistant Superintendent Machinery, Louisville & Nashville, Louisville, Ky.

ONE source of waste with which I am familiar, is driving box crown brasses, a detail common to all railroads, and nearly standard except for some minor differences. Crown brasses for locomotives have grown into huge castings, weighing from 220 lb. to 280 lb. each. They are from 1¾ in. to 2½ in. thick. All of them require machining on the outside and inside, which work is done on a boring mill, shaper, or lathe, according to the equipment at hand. The grooves required for heavy grease, the kind which is standard to nearly every railroad, are either milled or cut in with a pneumatic chipper. After the crown brass is carefully fitted and pressed into the driving box, it is ready for the bronze face which is poured directly into the recessed opening of the box. After hammering this bronze to insure a solid backing, the box is then faced off smooth so as to bring the bronze ring face and the crown brass end into the same plane, or flush with each other.



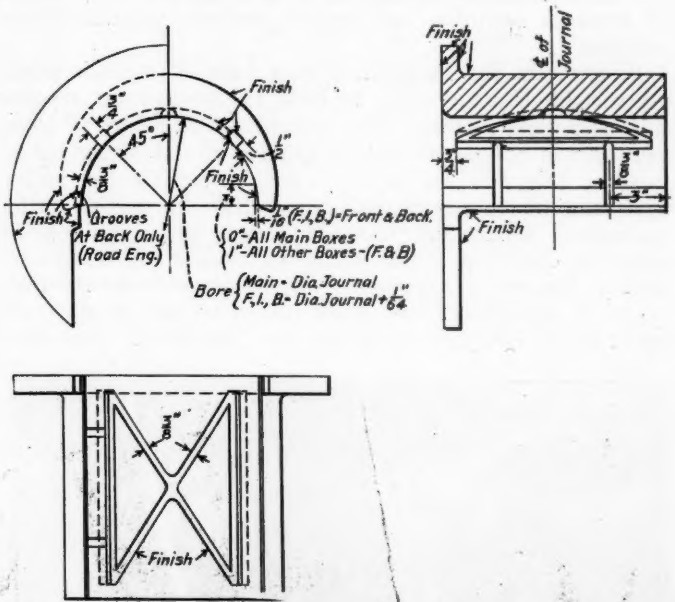
Crown Brass with Flange and Grease Grooves Cast Intregal

There are a number of distinct losses in this practice, namely, the loss of fuel and metal in casting on the bronze face; the loss of metal in machining the bronze face; the loss of time rehandling the box while casting on the bronze face; the loss of metal due to cutting the grease grooves in the crown brass; the loss due to wear and tear on air tools, and the loss of time chipping the grooves and dressing them up.

The above is standard practice in most railroad shops, varying a little as to the style and number of grease grooves and hub face arrangement. Sometimes a bronze ring face is cast into the driving wheel hub working against the cast steel box face, but this is not a satisfactory enginehouse proposition.

In order to overcome these losses of time, material and equipment, we adopted several years ago, a one-piece crown brass with the flange cast integral as shown in the illustration. This style crown brass requires only two operations in the finishing, boring and facing the inside of the flange, and shaping the two edges. It is then pressed into the driving box and is complete, ready for the final boring and facing.

The grease grooves are cored into the crown brasses by an improved foundry method deserving of special notice. A system of metal cores is implanted firmly into a half circle




One Piece Crown Brass Showing Finished Dimensions for Grease Grooves and Flange

dry sand core so as to form clean spaces, mechanically perfect in contour. It is obvious that this method may be varied to conform to any desired style or system of grease grooves. One piece style crown brasses have been used in different parts of the country for a long time, but have not been generally adopted.

By the use of this design we have obtained a much better wearing flange, as the metal is more uniform, besides it establishes an absolute standard for grease grooves in exact accordance with drawings, something which could not be obtained before. The foundry labor, and extra core work, as anticipated, has added some extra expense to the production of the castings, but after a test of six or seven years, we find this is fully justified. By the most conservative system of accounting, we find there is a tangible net saving of about $1.50 per average box.

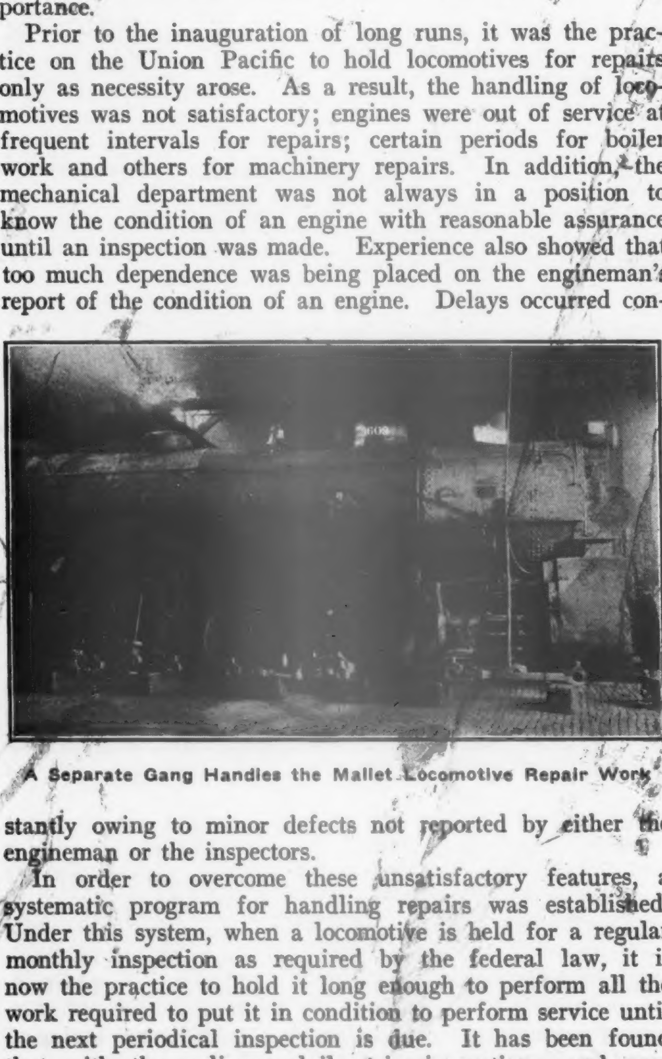
*Union Pacific Enginehouse at Cheyenne, Wyo., with the Locomotive Shop in the Background*

# Union Pacific Systematizes Running Repairs

## Periodical Detentions Reduce Locomotive Maintenance Costs 10 Per Cent with Increased Service

THE exacting transportation requirements attendant on the establishment of long locomotive runs on the Union Pacific has given the problem of improvement in terminal attention and repair methods particular importance.

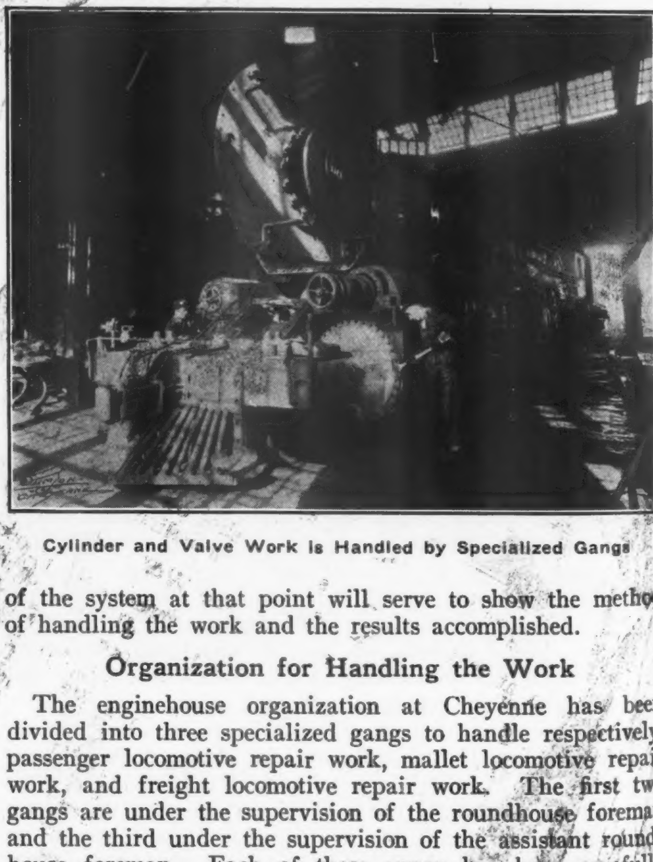
Prior to the inauguration of long runs, it was the practice on the Union Pacific to hold locomotives for repairs only as necessity arose. As a result, the handling of locomotives was not satisfactory; engines were out of service at frequent intervals for repairs; certain periods for boiler work and others for machinery repairs. In addition, the mechanical department was not always in a position to know the condition of an engine with reasonable assurance until an inspection was made. Experience also showed that too much dependence was being placed on the engineman's report of the condition of an engine. Delays occurred constantly owing to minor defects not reported by either the engineman or the inspectors.



**A Separate Gang Handles the Mallet Locomotive Repair Work**

In order to overcome these unsatisfactory features, a systematic program for handling repairs was established. Under this system, when a locomotive is held for a regular monthly inspection as required by the federal law, it is now the practice to hold it long enough to perform all the work required to put it in condition to perform service until the next periodical inspection is due. It has been found that with the ordinary daily trip inspections, and very light running repairs during the interval, locomotives can be prepared for and successfully operated over a period of 30 days with results that are very gratifying.

This plan was first put into effect at the Union Pacific enginehouse at Cheyenne, Wyo., and the following outline of the system at that point will serve to show the method of handling the work and the results accomplished.



**Cylinder and Valve Work is Handled by Specialized Gangs**

### Organization for Handling the Work

The enginehouse organization at Cheyenne has been divided into three specialized gangs to handle respectively, passenger locomotive repair work, mallet locomotive repair work, and freight locomotive repair work. The first two gangs are under the supervision of the roundhouse foreman and the third under the supervision of the assistant roundhouse foreman. Each of these gangs has been carefully organized according to the number of engines to be maintained and the requirements of the different types of locomotives handled by the gang. Men are assigned exclusively to certain work in order to secure the best possible results.

The use of two forms, samples of which are reproduced,

has been inaugurated to facilitate handling the work, and to establish a definite record of the inspections. One of these forms covers the various items connected with machinery inspection, and the other the boiler inspection. Each form provides space opposite the various items of work for the signature of the employee making the inspection and repairs, and both forms are duly approved by the officers in charge after final inspection of the locomotive under steam has been made.

### Character of Work and Time Expended

Locomotives are given a thorough inspection, and all work shown on the forms is taken care of, together with

UNION PACIFIC SYSTEM
UNION PACIFIC RAILROAD COMPANY
AND
ST. JOSEPH & GRAND ISLAND RAILWAY COMPANY

LOCAL
TEM. FORM 19

MONTHLY LOCOMOTIVE INSPECTION REPORT

Engine No.________ Date________ Location________

| Group | Character of Test and Work Required. | Name of Workman Assigned and Performing Work |
|---|---|---|
| | Give engine a thorough general inspection. | |
| 1 | Grind in and align gauge cocks. Rebore, repack and clean out water glass cocks and water column. Pack and repair all fountain valves. Grind in drifting valve throttle. | |
| 2 | Overhaul shut-off feature and grind boiler checks. Grind in lubricator and steam heat throttle. Overhaul blow-off cocks, regrind whistle valves and repair rigging. Examine and repair injectors and water supply. Water test steam pipes and superheater units. Examine and repair low water alarm. | |
| 3 | Date air pump applied ______ Date air pump laundered ______ Examine and clean air pump governor. Examine and repair all air brake equipment. Test and repair reversing gear and tag same. Inspect and repair drifting valve and tag same. Examine chokes in cylinder and valve oil lines. Test and repair bell ringer. Make air pump orifice test. Air pump reverse rod examined. Examine and test air reservoirs and pipes for loose connections and clamps. | |
| 4 | Regrind and repair drain cocks to water glass and columns. Align dripper to gauge cocks and clean out drain pipe. Examine and repair all piping and tighten clamping. Examine, clean and repair cab heater equipment. | |
| 5 | Examine and repair fire fighting valve and steam heat line. Examine and align sand pipes. Test out fire hose, repair and tag same. Repair ashpan spray and test same. Examine and repair water connection on engine and tender. Examine blower pipe and see if same is secure. | |
| 6 | Test out and repair stoker, per instructions. Test out and repair coal pusher. | |
| 7 | Examine and repair all electrical equipment. | |
| 8 | Test and repair superheater damper outside of smoke box. Examine nozzle tip and split and draft appliances. | |
| 9 | Inspect and repair cab windows, curtains and deck. | |
| 10 | Examine and repair valve gear. Check reach rod adjustment. | |
| 11 | Examine cylinder packing. Examine and repair all rods, crossheads and guides for pounds etc. Oil and adjust all wedges. Inspect and tighten all loose binders. Clean and repair channel cocks and cylinder cocks and rigging. Clean, repair and oil expansion pads. Whitewash piston rods and test. | |
| 12 | Adjust tender and driver brake piston travel. Examine and repair spring rigging. Examine, tighten and repair truck, trailer and tank boxes. Examine and repair all draw and draft rigging. | |
| | Grind in by-pass valves. Examine intercepting valves. Grind in separate exhaust valves (mallets only). | |
| | Reinspect and test out engine and place card in cab. | |

Engine given thorough inspection.

________ Machinist Inspector

APPROVED________ Dist. Foreman or Shop Supt. ________ Machinist Foreman

INSTRUCTIONS: This report must be filed for each locomotive in service each calendar month. All defects disclosed and reported must be repaired before engine is allowed to go into service. Report to be filed after approval in District Foreman's office. Workmen must sign opposite work assigned and performed.

**Monthly Locomotive Inspection Form Which Indicates the Extent of the Work Done at Each Monthly Repair Period**

additional work which may be found necessary, such as dropping wheels, renewing flues, etc.

The average number of man-hours expended in performing this work on the different classes of locomotives at Cheyenne is as follows:

| | Machinery work Man-hours | Boiler work Man-hours | Total Man-hours |
|---|---|---|---|
| Passenger locomotives | 264 | 48 | 312 |
| Mallet locomotives | 330 | 72 | 402 |
| Other freight locomotives | 228 | 48 | 276 |

### Increased Efficiency Obtained

The inauguration of this plan has practically eliminated the various minor defects which caused or contributed to engine failures, such as leaky boiler checks, gage cocks, brick arches, fireboxes, etc. A reduction of 60 per cent in freight locomotive failures per 100,000 miles was effected on the Union Pacific during the first six months of the present year, compared with the same period last year, and a reduction of 47 per cent in the number of passenger locomotive failures. The present average performance as regards engine failures is one failure per 100,000 locomotive miles. A better showing is anticipated when the system has become well established at all of the smaller roundhouses.

By means of periodical repairs, the Union Pacific has also been able to increase the monthly mileage of locomotives although at the present time, on account of the many other features involved, a definite statement regarding the amount of this mileage increase cannot be made. However, the available time of locomotives running out of Cheyenne has been increased from approximately 564 to 640 hours a month.

In addition it has been found that the present method of handling repairs effects a substantial decrease in the cost of maintaining power. A locomotive which formerly required an average of 615 man-hours a month for inspection and repairs is now repaired in 553 man-hours, or with a decrease of 10 per cent.

As previously stated, this outline covers the system for handling the work at Cheyenne. The practice and the results are substantially the same at all other large terminals on the Union Pacific. At smaller terminals, where the

UNION PACIFIC SYSTEM
UNION PACIFIC RAILROAD COMPANY
AND
ST. JOSEPH & GRAND ISLAND RAILWAY COMPANY

LOCAL
TEM. FORM 18

MONTHLY LOCOMOTIVE INSPECTION REPORT

Engine No.________ Date________ Location________

| Group | Character of Test and Work Required. | Name of Workman Assigned and Performing Work |
|---|---|---|
| | Ashpan and front end inspected and repaired. | |
| | Flues blown out. | |
| | Front end tested for air leaks and repaired. | |
| | Firebox tested for broken staybolts and reported. | |
| | Telltale holes and staybolts cleaned out. | |
| | Arch tubes cleaned out and turbined. | |
| | Grates and grate rigging repaired. | |
| | Inspect and repair superheater damper inside of smoke box. | |
| | Inspect draft appliances inside smoke box. | |
| | Inspect nozzle tip and bridge. | |
| | Splash plates in water tank examined and repaired. | |
| | Cab and running board examined for loose bolts, etc. | |
| | Running boards inspected and repaired. | |

Engine given thorough inspection.

________ Boiler Inspector

APPROVED________ Dist. Foreman or Shop Supt. ________ Boiler Foreman

INSTRUCTIONS: This report must be filed for each locomotive in service each calendar month. All defects disclosed and reported must be repaired before engine is allowed to go into service. Report to be filed after approval in District Foreman's office. Workmen must sign opposite work assigned and performed.

**This Form Is Devoted to the Boiler and Its Appurtenances**

number of locomotives handled does not warrant special gangs for the various types of locomotives, the work is being taken care of by men regularly assigned to certain definite items of work. The same forms are being used, and the same practice is followed in giving the engine periodical and systematic repairs.

By this system, the mechanical department officers of the Union Pacific believe that a considerable advance has been made toward solving some of the more important

problems on which depend the success of long locomotive runs.

Periodical repairs to locomotives give an assurance of power that can be relied on to meet transportation requirements at a cost for up-keep that is 10 per cent below the former cost, and with a substantial increase in the number of hours that power is available for service.

# Machine for Locating Eccentrics on Axles

By L. V. Mallory

Gang Foreman, Missouri Pacific, Kansas City, Mo.

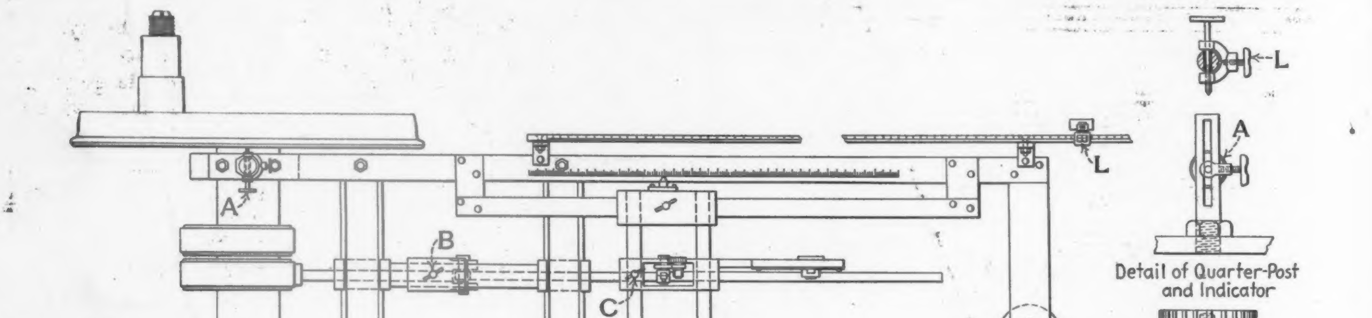
A MACHINE for locating eccentrics on the axle before it is placed under the locomotive has been developed and successfully used in the Kansas City shops of the Missouri Pacific. By its use considerable time is saved in setting the valves of a Stevenson valve gear locomotive as it eliminates the necessity of locating dead centers and changing the keys after the engine is assembled. The machine can be made with little expenditure in any railroad shop. The following is a detailed description of its construction and operation.

A rectangular frame, open at one end, is made from ¾-in. by 4-in. bar iron. At the open end a V-block is secured to the bottom of each leg which saddles over the journal of the axle to which the eccentrics are to be applied. On the upper side of each leg are secured two longitudinal guide bars which carry the rocker arm crossheads. These in turn carry the transverse guide rods on which are mounted the rocker arm and an indicator assembly consisting of an indicator and card holder.

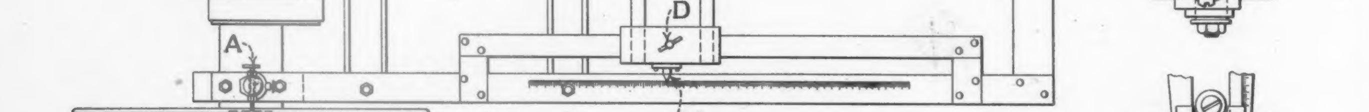
The rocker arm is made of light material, having at each end a slot of sufficient length for the movable pins to be adjusted to correspond to the valve rod pins and link block pins of various classes of engines on which the machine is to be used. For convenience, a scale is provided at the edge of these slots and a small indicator is located on a horizontal line through the center of each pin.

On the under side of the frame are two transverse guide bars located so that the eccentrics will clear the one nearest to the axle. These guides carry, suspended between them, the longitudinal guide on which is hung the eccentric stop. A small screw jack, which may be mounted on small wheels or castors, supports the front end of the locater frame which facilitates leveling adjustments. There is a small spirit level over the jack on the frame.

Above each of the V-blocks on the open end of the locater




Machine in Position for Locating the Left Forward Eccentric on an Outside Admission Indirect Engine




Eccentric Locater for Locating Locomotive Eccentrics Correctly on the Axle Before the Wheels Are Replaced

frame is a quartering post. These posts are slotted to receive crank pin indicator points which are secured by winged set screws to suit any crank pin throw and, when the frame is level, the points lie in a vertical plane through the center of the axle. On one leg of the frame and immediately over the rail is secured the guide of the main rod angularity finder and telescope scale. This guide is parallel with the frame and extends a sufficient distance beyond the end of the frame to accommodate the length of any main rod. On it is carried the angularity finder from which is suspended a telescope scale reaching down to the rail. The guide is graduated, zero being at the center of the quartering posts.

The drawings show the machine in position for locating the left forward eccentric of an indirect outside admission engine. Therefore, to avoid confusion, it will be assumed that this is the one to be located. First, place the wheels so that right crank pin is approximately at the top quarter. Place the locater frame in position with the closed end ahead of the wheels and the V-blocks resting on the journals. Level the locater frame with the jack. Find the distance between the centers of the front and back end main rod brasses and set the main rod angularity finder at the corresponding graduation on the finder guide. The next step is to find the distance the center of the crosshead pin is above or below the cylinder center line. Adjust the frame with the jack until a corresponding distance is recorded by the telescope scale. Roll the wheels slightly until the indicator point on the quartering post finds the center of the right crank pin, then block them securely in this position and bring the locater frame to a level position again.

Now put the eccentric on the axle in such a manner that it can be moved without disturbing the position of the wheels. Put the proper valve event card in the indicator and set the pins in the rocker arm in the position to correspond to those of the valve rod and link block pins in the actual rocker arms of the engine. With the stop rod connection screw released, slide the rocker arm crossheads until their indicator points rest on the graduations corresponding to the link radius of the engine. Secure the rocker arm in this position with the wing screws located on the rocker arm crossheads.

Turn the left forward eccentric on the axle until its thinnest part is between the axle and the eccentric stop and fix it temporarily in this position by one of its set screws. Then bring the eccentric stop back against the eccentric and secure it to its guide with the wing set screw.

With the connection screw still released, move the valve event indicator forward until it registers on the extreme forward valve travel mark of the indicator card. Then securely tighten the eccentric stop rod connection screw. This operation connects the eccentric stop with the indicator. Now release the eccentric stop on its guide and move it forward until the indicator registers on the lead line just ahead of the forward port mark, and again firmly clamp it to its guide. Release the left forward eccentric and bring it to rest on the eccentric stop, which is its correct location. Compare the keyway and order the key offset to suit.

Leaving the machine set as above, slide the longitudinal guide and rocker arm assembly over in alinement with the left backward eccentric. This eccentric may now be located, it being necessary, however, to move it upward until it meets the eccentric stop. In some cases less lead is desired in the backup position. This is accomplished by merely releasing the locking screw and placing the indicator closer to the port mark on the card and resetting the set screw.

Right side eccentrics are located by placing the left crank pin in the same position as now occupied by the right crank pin near the top quarter. The right crank pin, when in this position is on the forward dead center, hence the indicator must register near the back port mark and the right front eccentric moved upward to meet the stop and the right back eccentric downward to meet the stop.

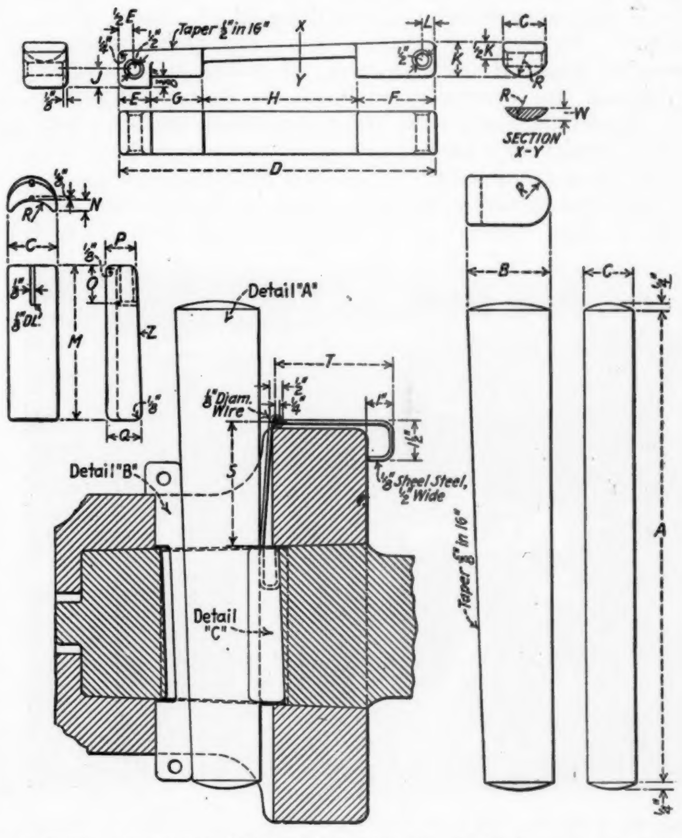
# Locomotive Crosshead Puller

By E. A. Miller

THOSE who have experienced considerable trouble in cutting crossheads loose from the pistons will find the device shown in the illustration a time saver in doing this job. It is simple in construction, easy to handle and in no way difficult to apply.

The device consists of four parts which are made from axle steel. The detail *A* is the wedge which is driven in to pull the crosshead. It is a piece of steel tapered 5/8 in. in 16 in. Detail *B* is a steel block which is placed toward the rear end of the crosshead. It is flat on the side which bears against the wedge *A*, but is rounded in three places on the opposite side, two of which fit against the rounded end of the key slot in the crosshead. The recessed portion in the center is rounded to fit in the end of slot in the piston rod when the crosshead has been drawn loose from the rod.

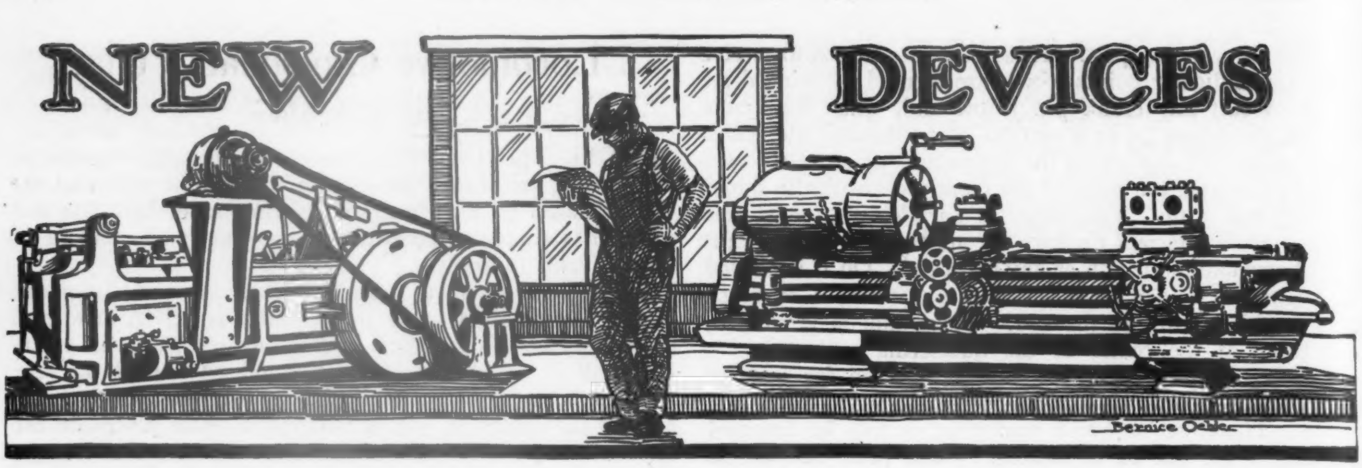
Detail *C* is a small block slightly shorter than the diameter of the piston rod at the slot where it is used. It is crescent




**Effective Crosshead Puller Adaptable to Enginehouse and Back Shops**

shaped on the end, the outer radius to fit the corresponding half-round end of the keyway in the piston rod, while the inner radius is the same as that on the rounded side of the key. A 1/8-in. hole is drilled through this block and a 1/8-in. groove is cut along both rounded surfaces at the upper end. This is for the purpose of receiving a 1/8 in. wire to hold the block in place. The wire extends to the outside of the crosshead ring and there goes through a 1/8-in. by 1/2-in. steel plate which hooks over the end of the crosshead and prevents the crescent block from turning laterally.

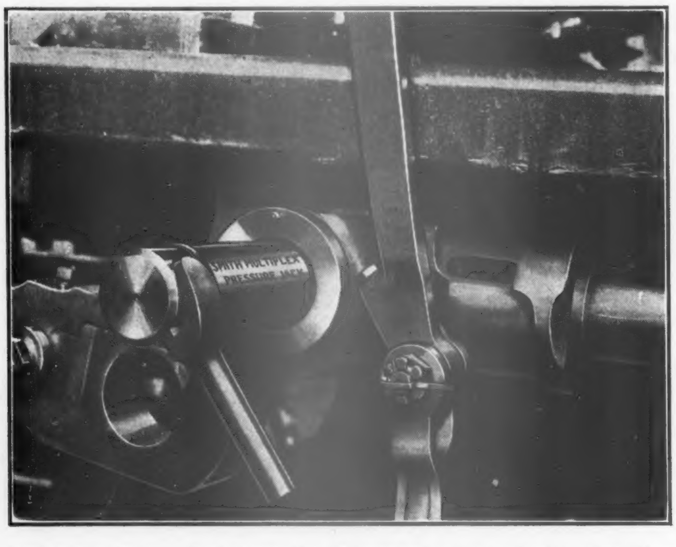
After setting up the device the crosshead barrel should always be heated slightly before using, as quicker results with less resultant damage to the puller will be obtained. When heating, it is advisable to protect the babbitt on the crosshead with sheets of asbestos so that it will not melt off.




# Smith Multiplex Pressure Jack

A JACK that can be used in a 2-in. to 5-in. space and which has a lifting capacity from 25 to 100 tons has recently been designed by H. J. Smith, Philadelphia, Pa., and is designated as the Smith multiplex pressure jack. It is especially adaptable to the railway field and has been used with success in pulling pistons, loosening tight bolts, removing engine truck brasses, changing car and tender bearings and jacking-up equalizers when applying or removing driving, trailer and truck springs.

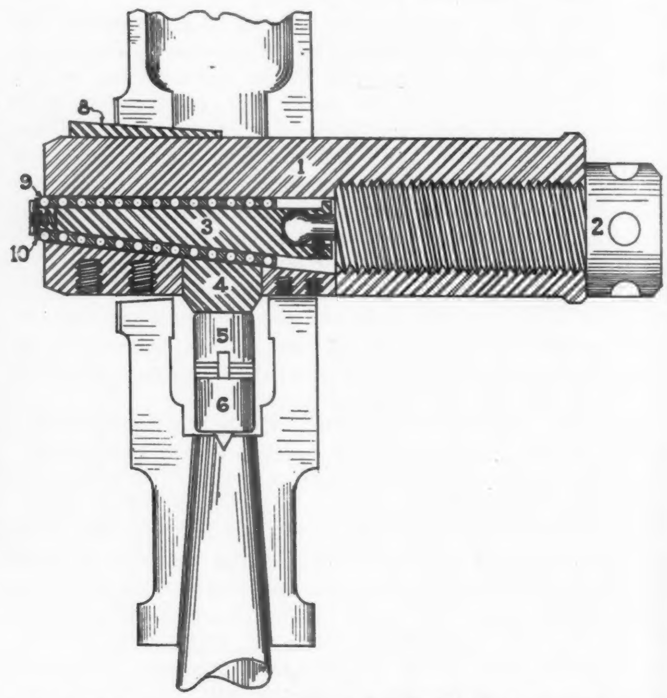
The cross-section of the jack shown in the illustration will give a clear conception of the construction and principle of the jack. It consists of a cylinder which is threaded for the pressure screw. The screw is drawn up against the longitudinal and transverse wedge which runs on roller bearings. The pressure is transmitted through the transverse wedge to the parts for which it is intended by means of suitable filler piece.




**Forcing a Piston Rod from the Crosshead with a Smith Multiplex Pressure Jack**

The operation of the jack is simple and it can be easily handled by one man. If the workman is going to force a piston from the crosshead, the jack is first placed in the wrist pin hole with the transverse wedge pointed toward the end of the piston rod. The pressure screw is run back by hand which also pulls back the longitudinal wedge. Before applying the pressure a final check should be given to see that the male and female filler piece is properly in place between the end of the piston and the transverse wedge. As the pressure is exerted on the longitudinal and transverse wedges the jack cylinder tightens in the wrist pin hole against the wedge shaped filler piece which is placed around the end of the jack.

In testing one of the jacks one man with a 19-in. bar is said to have lifted 81,000 lb., with a 4-ft. bar, 172,100 lb. and with a 6-ft. bar, 200,000 lb., or the limit of the testing machine. The capacity of the jacks is determined by the amount of taper in the wedges and the pitch of the threads on the pressure screw. The spring rigging and journal jacks are made in three different sizes. The spring rigging jack is 4 in. over all, which means that it can be used in a 4-in. space, lifting 50 tons. The car and locomotive jacks are 5¾ in. over all and are furnished with filler blocks so that they can be used for all sizes of car wheels and journal boxes when removing journal brasses. There are six sizes of jacks ranging from 50 to 100 tons in capacity and weighing from 55 lb. to 100 lb. They vary only 2 in. in length, the smaller size being 21 in. long and the larger size 23 in. long.



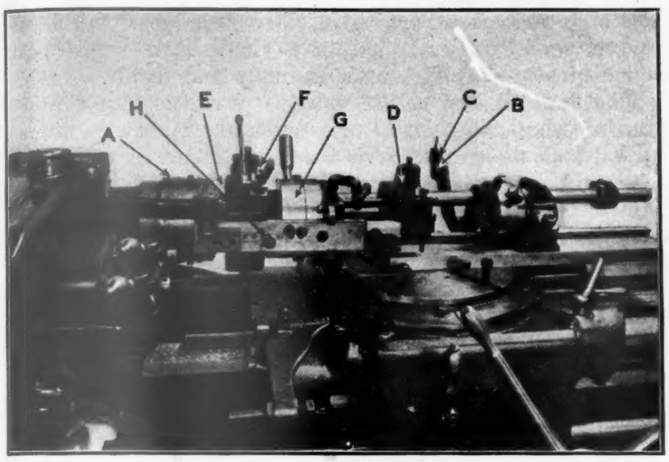

1—Jack cylinder; 2—Pressure screw; 3—Longitudinal wedge; 4—Transverse wedge; 5 and 6—Filler pieces; 8—Liner pieces; 9—Roller bearings; 10—Roller frame.

**Cross-section View Showing the Construction and Principle of the Jack**

# Staybolt Attachment for the Hartness Flat Turret Lathe

THE staybolt attachment shown in the ilustration has been developed by the Jones & Lamson Machine Company, Springfield, Vt., in order to simplify the turning and threading of staybolts, particularly the button-head radial type where the use of both straight and taper threads complicates this operation.

This attachment provides a method for mounting on the turret of the Hartness flat turret lathe a long extension tool plate. On this are fixed tool holders carrying two automatic die heads. At the side of the tool plate is a rigid bar which carries two turning and centering tools. These may be drawn down into position to take turning cuts and then thrown back out of the way so the thread dies may be used.




Staybolt Attachment for Simplifying the Turning and Threading of Staybolts

The tool plate is made of steel and is amply proportioned to give sufficient strength. The die heads are the standard Hartness automatic die heads. They may be set in the proper lead relationship by setting them down onto a master staybolt of correct pitch relationship. The front die head may be arranged to cut either straight or tapered threads. A graduated dial attached to the templet may be set to cut threads either straight or at any desired taper.

The two turners are made of steel castings and are said to be rigid enough so that it is possible to take skimming cuts over the bolt using the coarsest feed on the machine. This whole attachment may be taken from the turret by removing four or five bolts, which leaves the machine free for its regular work.

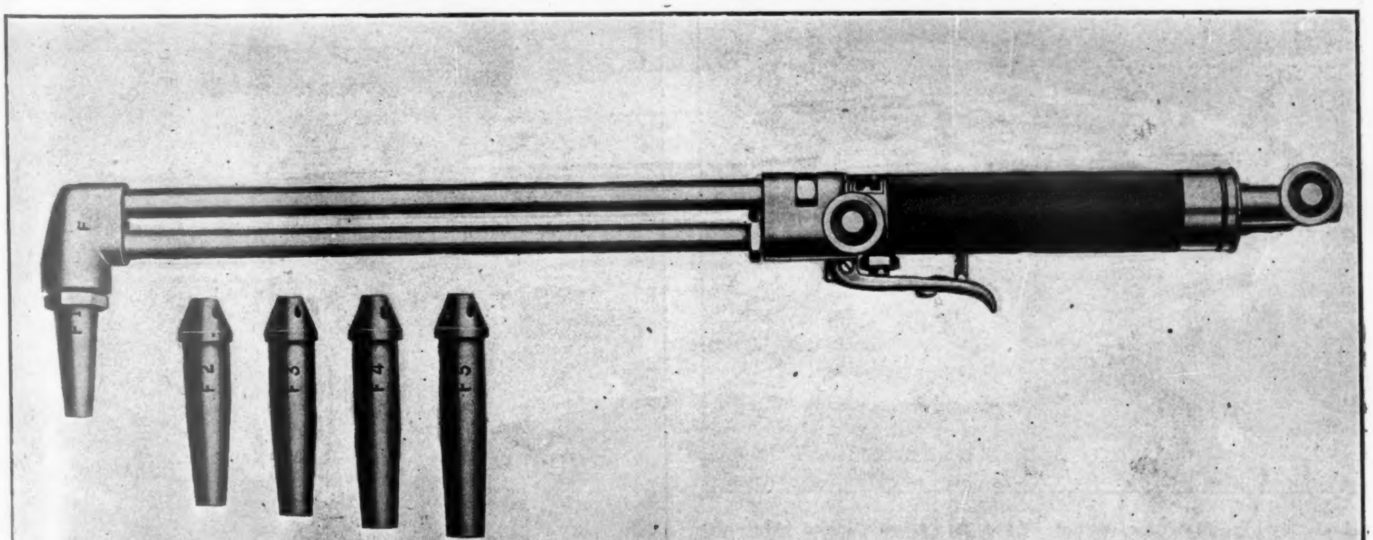
It is easy to operate. The staybolt is placed in the chuck *A*, and is centered in cup *B*. The cup is then thrown back out of the way by means of the arm *C*. Spherical seat jaws make it possible to chuck the square head no matter how irregular the forging.

The next operation is to engage the feed and turn the two ends simultaneously with the rear turner *D* and forward turner *E*. The forward turner will cut either straight or taper. The neck of the staybolt is cut with the tool *F*, after which the turning tools are thrown back out of the way.

The thread dies are engaged and the two ends of the bolt are threaded at the same time. The foreward die *G* will cut either straight or taper treads. The taper is generated by the use of the template *H*.

# Cutting Torches with Mixing Chamber in the Handle

THE Purox Company, Denver, Colorado, has recently put on the market two styles of cutting torches which embody several interesting features. These torches, designated as styles E and F, will operate efficiently on oxygen, in combination with acetylene, hydrogen, or other combustible gases, and can be used for welding, as well as for cutting. The transformation to a welding torch is effected by means of a welding tip adapter, which cuts off the high-pressure oxygen flow. The drop forged front head, the tubes and the drop forged mixing chamber are made from Tobin bronze. The lever-latch, pawls, screws and valve parts are made from stainless steel.




Style F Purox Cutting Torch Weighing 60 Oz. and Having a Cutting Capacity of 24 In.

One of the special features of design is the location of the mixer at the front of the handle, remote from the heat at the tip, which insures safety in operation, constancy of pre-heating flame, and an easily operated, well balanced

torch. The front end tubes can be easily removed, which permits the use of special tubes of any required length and also the use of 45-deg., 60-deg., 75-deg., or 90-deg. head angles. The front end can be changed merely by unscrewing two nuts at the juncture of the handle and the front end. The mixer can also be changed quickly and easily in the same manner, to accommodate changes from oxy-acetylene to oxy-hydrogen or any other oxygen fuel combination.

Repairs to these torches can be easily made in the field by ordinary mechanics as they are assembled in units. As an example, the high pressure spring valve controlling the oxygen flow, together with its seat, can be removed and replaced as a unit with a tested spare part. It is equipped with a small diameter valve stem which tends to reduce the friction of movement and thereby permits an unobstructed gas flow. The small diameter allows effective packing against gas leakage. It is thoroughly protected against external strains, however, by a large diameter protecting cap which also acts as a housing for the valve spring.

The cutting oxygen lever is placed on the lower side of the torch handle so that it can be conveniently operated by the first and second fingers. It is provided with a latch which locks the valve depressed to any desired extent thus relieving the strain upon the operator. Merely touching this latch releases the lever immediately and stops the high pressure flow. An adjustment screw compensates for the lost motion. This construction gives positive operation.

The oxygen and fuel tubes in the handle are silver-soldered into the forging at the front end of the handle. The handle tube is merely a sheath and cap, through which the oxygen and fuel connections are screwed with straight threads to their tubes in the handle. The strain involved in connecting or disconnecting hoses is, therefore, not transmitted to the tubes and connecting parts but is taken through the locking device and the handle itself. To remove the fuel connections it is merely necessary to unscrew the lock. The high pressure oxygen valve, mixing chamber, and flame-oxygen valve are contained in a single drop-forged part, which greatly simplifies both assembly and repair.

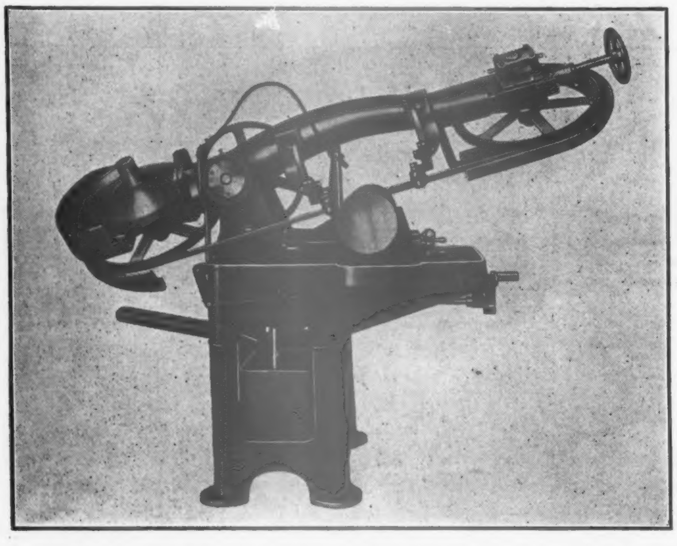
The flame-oxygen needle valve is provided with a round knurled wheel which is always under the operator's thumb, so that both the cutting oxygen and the flame are completely under the control of one hand, with the torch held in a natural position. The hose connections on these torches are on a horizontal plane instead of a vertical one, which reduces the drag of the hose on the operator's hand. The head is constructed with a female thread so that it is not easily damaged when the tip is not in place, the tip's retaining-nut having a male thread.

Styles E and F are 20 in. and 25 in. long, weight 46 oz. and 60 oz. and have a cutting capacity of 6 in. and 24 in. respectively.

# Band Saw Which Cuts Solid Bars and Tubing at High Speed

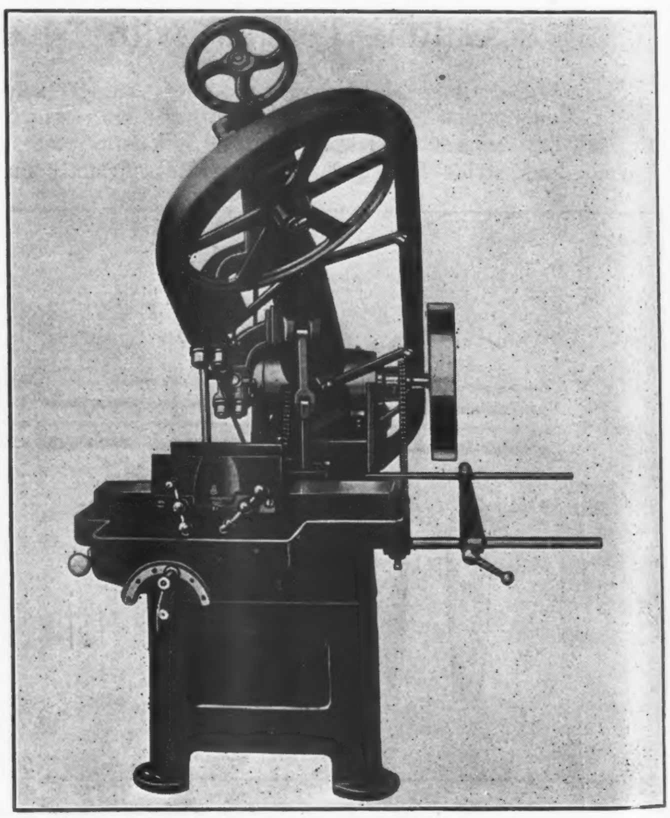
THE Henry G. Thompson & Son Company, New Haven, Conn. has developed a cutting-off machine of the horizontal band say type which is to be known by the trade name of Milband. It has several features not before applied to band saws for cutting metal, and is designed to cut stock of all sizes and shapes up to six inches.

A swinging frame carrying the band wheels is counterbalanced, so that there is no tendency for the saw to dig in because of soft spots or thin sections. The positive feeding movement is gear driven through a rack and pinion; is rigidly controlled, and the time of making a cut depends on the rate of feed for which the machine is set, which, of course, is determined by the size and nature of material being cut. By reason of this feature the same band saw blade, with five teeth per inch, cuts thin walled tubing with the same continuity of movements and rapidity as it cuts bar stock.



Metal-Cutting Machine Which Cuts at High Speed Material Ranging from Thin Tubing to Solid Bars of Annealed High Speed Steel and Monel Metal

There are six changes of feed speed, all controlled by a small crank lever to be seen in the front of the machine. An instruction plate permanently attached to the machine shows the correct feed setting for each grade of material and size of bar. As the machine is designed to cut anything from



End View of the Milband Metal Cutting-off Machine Showing Chain Drive and Speed Control Lever

thin tubing to solid bars of annealed high speed steel and Monel metal, a multi-speed countershaft is provided to change the lineal speed of the band in accordance with the nature of the material being cut. The feed and speed settings for all kinds of material and for various sizes of bar stock, by inches, from one to six, are shown on the instruction plate.

The main drive is through bevel and miter gears, having a reduction of 4 to 1 to the lower band wheel. From the first shaft power is taken off by chain and sprocket to drive the bank of spur gears, which, through the sliding key, controlled by the feed lever, determines the rate of feed for any given material. A second chain and sprocket drives a small centrifugal pump that supplies lubricant to the cut from a settling tank within the base of the machine.

The work holding vise is double and the jaws are independently controlled, so that the material to be cut is held firmly on both sides of the kerf. This feature permits the cutting of discs or slabs as thin as 1/8 in. without endangering the saw band or allowing the cut to creep sidewise. The band is guided both before and behind the cut by two pairs of hardened steel rollers mounted on ball bearings.

The feed is engaged and released by means of a pull-rod that terminates in a knob beside the feed control lever. When starting a cut, the operator pulls down the arm until the saw contacts with the work and then engages the feed clutch. The saw then cuts through the material at a continuous, definite rate established by the particular feed gears then in mesh, until the piece is cut off, when the feed disengages itself.

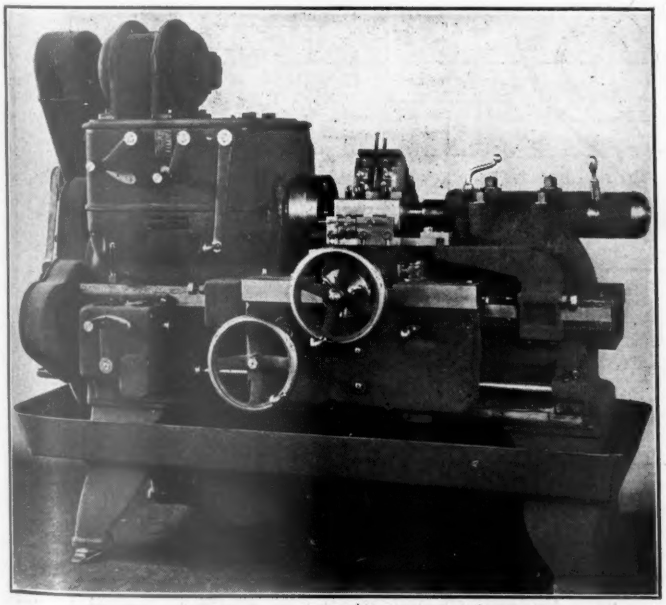
A special blade, produced by the manufacturer, is used. The band is 12 ft. 11 in. long, 3/4 in. wide, and .031 in. thick. The teeth are pitched five to the inch and are set to make a kerf .050 in. wide. The idle band wheel runs on ball bearings and is supported by a screw operated sliding block that is adjustable for the purpose of maintaining the tension on the band. The band is guarded on the idle side and around both wheels by a rigid aluminum guard that protects the operator from injury. A band can easily be changed by the operator without assistance.

The machine is designed to be driven by a 2-in. belt from an overhead countershaft, but if desired, a direct connected motor can be substituted. The motor bracket bolts to the rear of the base and a silent chain and sprocket are substituted for the belt and pulley. A variable speed motor can be used and the speed of the band determined from the control box, or changeable reduction gearing may be used in connection with a uniform speed motor. The machine requires about 2 h.p. to drive it. The floor space occupied by the belt driven machine is 6 ft. by 3 ft. 8 in., approximately 22 sq. ft., and weighs 1,050 lb.

# Four Speed Production Lathe

A LATHE adapted for straight, taper and form turning, straight and bevel facing, recessing and straight and form boring has recently been added to its line of machine tools by the Reed-Prentice Company, Worcester, Mass. Its rugged construction permits a series of heavy cuts to be taken at one time, both with the front and rear tools.

The headstock is of box construction arranged with four spindle speeds which are obtained through sliding gears positioned through crank handles conveniently located on the front of the headstock. The drive is through a disc clutch and brake located at the rear of the head and operated by a hand lever at the front of the headstock. This arrangement of levers provides for simple manipulation, while the disc clutch and brake give instantaneous starting and stopping.



Reed-Prentice Lathe Arranged for a Herringbone Gear Connected Motor Drive

The headstock can be furnished with either belt or motor drive. The illustration shows it arranged for herring-bone gear connected motor drive with all gears running on ball bearings. The motors used range from 5 hp. to 20 hp., depending upon the class of work.

All of the headstock gears are of hardened steel and the driving gears to the spindle are of the herring-bone type to provide a smooth power transmission. All of the gear shafts in the headstock, with the exception of the spindle, run in ball bearings, while the spindle journals are hardened and ground and run in bronze bearings.

The cam tailstock provides for quick withdrawal of the tail center as well as a fine adjustment of the center in the work. This provides for quick loading, and a hand clamp locks the tail spindle when the machine is in operation.

The carriage is extra heavy throughout, and the carriage bridge is supported on a right angle bearing inside of the bed, directly under the front tool holder. The apron is arranged with independent power longitudinal and cross feeds, either of which may be engaged separately. Both the longitudinal and cross feeds are automatically operated and tripped in both directions, the direction of the feed being determined by the position of the hand lever projecting from the front of the apron. The changing from longitudinal to cross feed, and vice versa, is obtained by a pull gear controlled from a handle protruding from the front of the apron. The operation of the automatic trips is simple and dependable, and with the use of positive bed and cross stops, very accurate positioning of the tools may be obtained.

Both the rack pinion and cross feed hand wheels are large in diameter, while the latter is arranged with a large micrometer dial.

The feed box regularly furnished gives four feeds, and by compounding the standard gears constituting the end works, three additional feeds may be obtained. The changing of the feed in the gear box is accomplished through

sliding hardened steel gears operated by a crank handle at the front of the box.

The facing and chamfering operations are obtained through the use of a Reed-Prentice patented back arm attachment provided with sensitive worm adjustment for the relationing of the tools to the work. This attachment is sturdy in construction, and has a long angular support bearing on the lower part of the bed.

The entire headstock is lubricated through a splash system, and the sight feed oiler shows the level of the oil at all times. All apron bearings are oiled from pipe connections to an oiler at the top of the carriage, while the feed box bearings are lubricated from pipe connections to the top of the box. Other bearings are arranged with oil cups conveniently located.

Various sizes and types of tool holders and drivers can be furnished to suit the large variety of work for which the machine is adapted.

# The Street Locomotive Starter

A LOCOMOTIVE starting device has recently been developed by Clement F. Street, Greenwich, Conn., which is the result of four years of experimental work, during which time nine machines were built and tested. Referring to Fig. 1, the device consists essentially of two cylinders which are arranged parallel to each other, with their pistons and connecting rods. The outer end of each connecting rod is secured by a pin to a pair of swinging arms carried on the axle. Between each pair of swinging arms is a ratchet wheel pressed and keyed to the axle, and a ratchet is pivoted to each pair of arms, as shown in Fig. 2. This ratchet is held out of contact with the ratchet wheel by a spring. The cylinder casting has two bearings formed on the front end, outside of the arms, to carry the weight of the front end of the starter. The back end is carried by means of a flexible support to the truck frame. This method of carrying the cylinders is similar to that used in supporting street railway motors.

Steam is admitted to one end of the cylinders only and consequently the back end of the connecting rod is pivoted directly in the piston which makes possible a short, light construction. Owing to the use of this trunk type of cylinder, only one valve is used and this is placed in the rear cylinder head. This is of the plain piston type. It is thrown by steam pressure and has no mechanical connection with other movable parts of the starter. A nest of flat circular springs in the valve chest head furnishes a cushion for the valve to strike against at each end of its stroke.

The novel feature of the motor is the method of coupling together the two pistons by a cross lever pivoted to the cylinder casting, so that when one piston is driven forward by the steam pressure it pulls the other piston back. The stroke of the piston when working is about 8 inches. Just before the piston reaches the outer end of its power stroke, it uncovers a port in the cylinder and admits steam through the valve chest head to one end of the valve which reverses its position. This cylinder is thereby opened to the exhaust and steam is admitted to the other cylinder. This operation is continuous as long as there is steam pressure in the valve chamber.

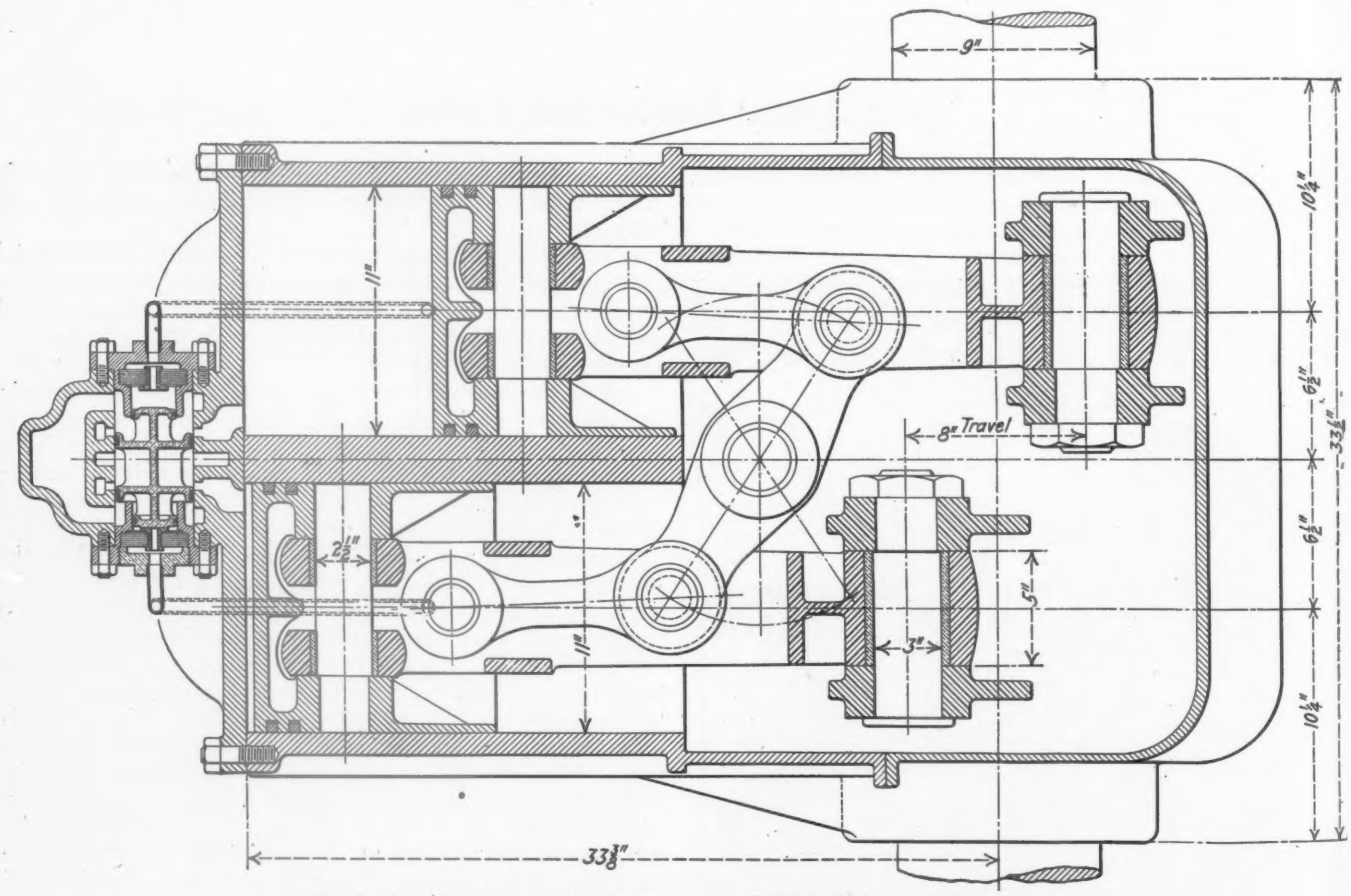


Fig. 1—Drawing Showing the Arrangement of the Cylinders and Piston Rods

The two cylinders with the valve, their pistons and cross lever connection make an operative machine which will run with the connecting rods disconnected. The cross connection between the piston, with the absence of cranks and fly wheels, eliminates the need for a governor as the motor can-

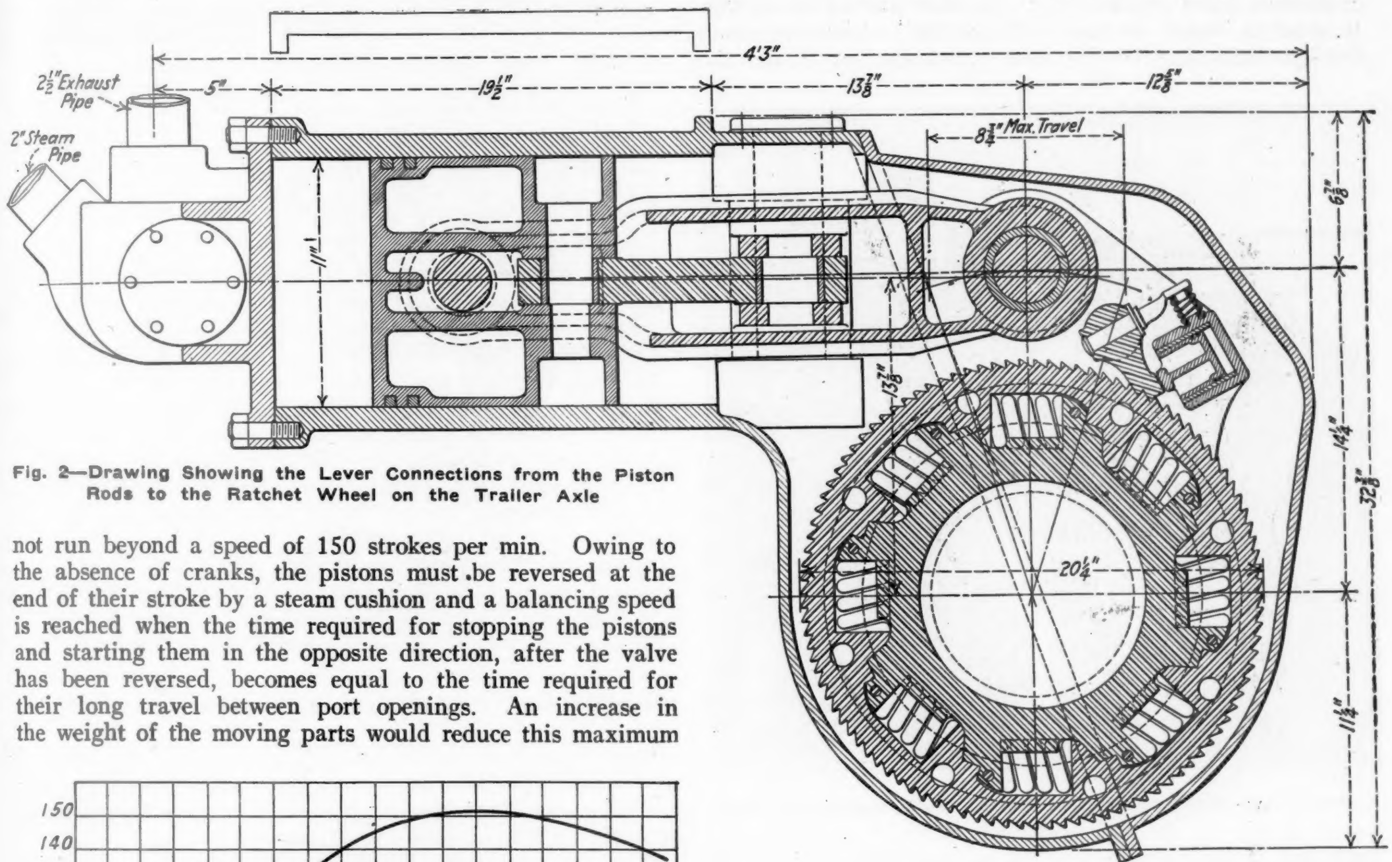



Fig. 2—Drawing Showing the Lever Connections from the Piston Rods to the Ratchet Wheel on the Trailer Axle

not run beyond a speed of 150 strokes per min. Owing to the absence of cranks, the pistons must be reversed at the end of their stroke by a steam cushion and a balancing speed is reached when the time required for stopping the pistons and starting them in the opposite direction, after the valve has been reversed, becomes equal to the time required for their long travel between port openings. An increase in the weight of the moving parts would reduce this maximum

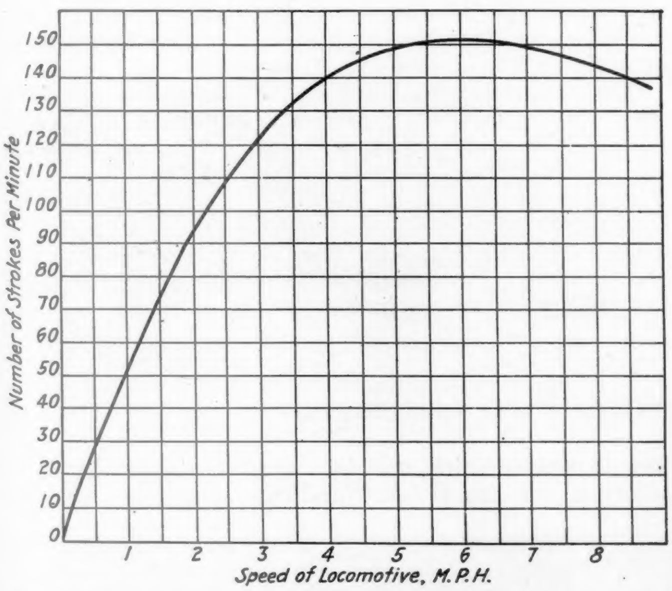



Fig. 3—Curve Showing the Relation Between Strokes and Speed

speed and a reduction in their weight would increase it somewhat.

Fig. 3 shows the results of a series of tests made to determine the maximum speed at which the locomotive could be run with the greatest number of working strokes of the starter. It was found that after six miles per hour the number of strokes began to decrease. This feature in the starter's operation shows that its greatest service is performed at slow speeds and it can be automatically cut off at six miles per hour.

The ratchets are normally held out of contact with the ratchet wheel by springs. Steam pressure, when admitted to the cylinder, is also admitted to a small cylinder above the ratchet for that cylinder and forces it down in contact with the wheel. It remains in this position as long as there is pressure in the main cylinder. When the pressure in the main cylinder is reduced to exhaust, the pressure is also reduced in the ratchet cylinder and the spring lifts the ratchet clear of the wheel. The machine is thus always ready for action, with no preliminary throwing of clutches or shifting

A Front View of the Locomotive Starter Attached to a Stationary Boiler for Testing Purposes

of gears. When the steam pressure is cut off from the starter the parts come to rest in whatever position they may be in, except that the ratchet spring will lift the ratchet clear of

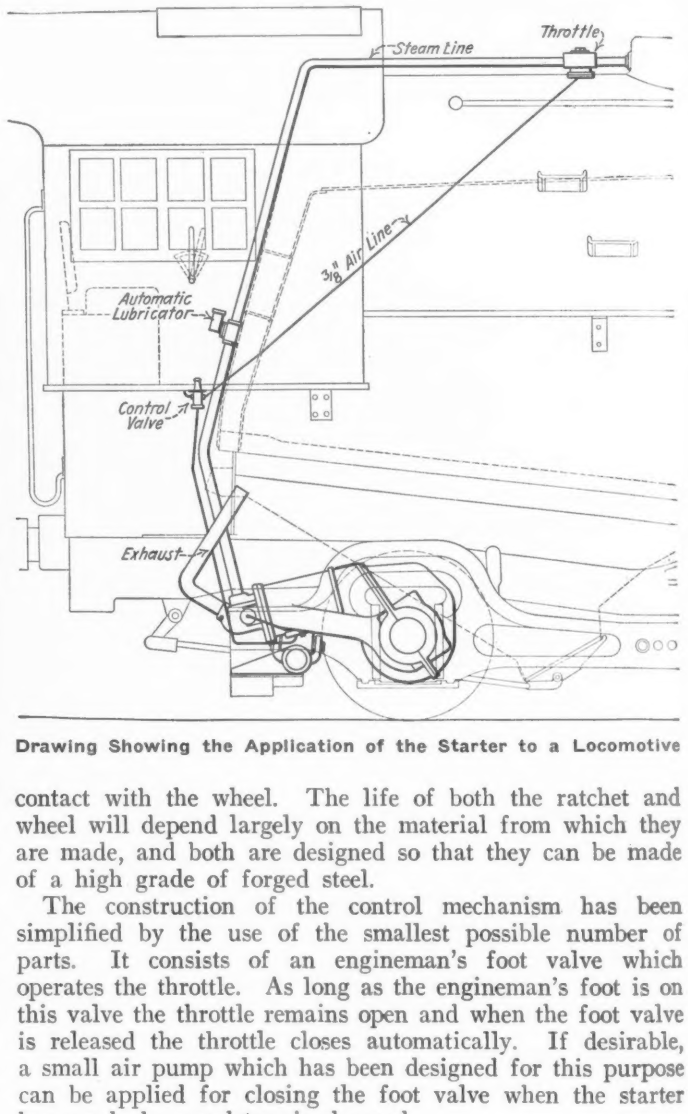
the ratchet wheel, and they are ready to resume operation as soon as the steam is turned on again.

All of the parts of the locomotive starter are easy of access and may be inspected without removing the device from the locomotive. The valve chest heads may be taken off and the valve removed without disconnecting the steam or exhaust pipes or disturbing any other part of the starter. In order to inspect or remove the ratchet and its attachment the locomotive can be run over a roundhouse pit and the

A Rear View of the Locomotive Starter While Undergoing Tests

back end of the machine lowered until it hangs entirely on the axle. In this position the front cover can be removed and all of the parts on the axle exposed. The support for the back end of the starter is made with a removable section which can be taken out in case it is desired to lower the back end.

The work to be done by the ratchet is heavier than that which is usually required of such a device, but there are at present in use machines which have ratchets that carry loads almost as heavy. In many cases these are running constantly, while the starter is run only for short periods. The ratchet wheel is fitted with a series of coiled springs which cushion the action of the ratchet when it comes in




Drawing Showing the Application of the Starter to a Locomotive

contact with the wheel. The life of both the ratchet and wheel will depend largely on the material from which they are made, and both are designed so that they can be made of a high grade of forged steel.

The construction of the control mechanism has been simplified by the use of the smallest possible number of parts. It consists of an engineman's foot valve which operates the throttle. As long as the engineman's foot is on this valve the throttle remains open and when the foot valve is released the throttle closes automatically. If desirable, a small air pump which has been designed for this purpose can be applied for closing the foot valve when the starter has reached a predetermined speed.

# An Automatic Lathe with Two Carriages

An automatic lathe with multiple tooling for performing turning and facing operations has been placed on the market under the trade name "Duomatic" by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio. This machine is adapted for the quantity production of lathe work, whether held between centers, on an arbor, or in suitable fixtures. The cycle of operation is completely automatic, including the control of diameters and the lengths on the work. The proper dimensions are obtained by means of positive metal-to-metal stops which insure a high degree of accuracy.

As its name implies, the Duomatic is dual in character, having two carriages equipped with tool slides. Each of these units has an independent power quick forward and return traverse, as well as a power feed to both the carriage and the tool slide. As a result, both carriages can be used simultaneously, or, as is usually the case, one carriage with its tool slide can be utilized in a turning operation, while the other is being used in a facing and fileting operation. The dual construction, combined with the simple method of adjusting for the various functions, makes the machine


Automatic Lathe Having Two Carriages Equipped with Tool Slides

adaptable for a variety of work without the use of special attachments or parts. The rotation of the feed screw gives the cross movement to the tool slide and the longitudinal movement to the carriage. An adjustable threaded micrometer sleeve arrests the movement of the cross slide to fix the diameters of the work and the adjustment of a pair of nuts on a threaded stop bar limits the movement of the carriage in either direction.

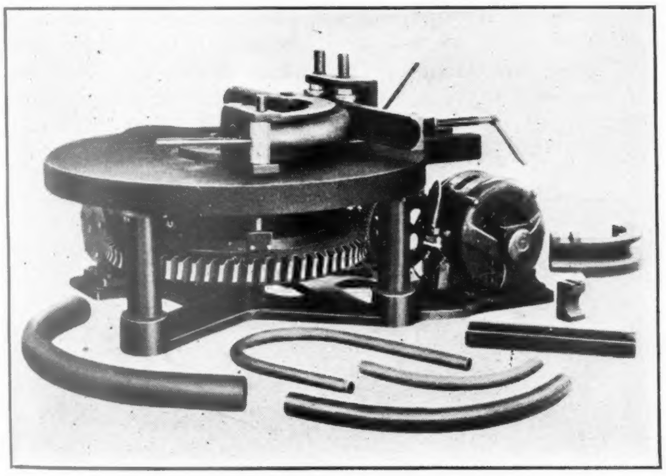
The single pulley drive with its multiple plate clutch is said to transmit unusual power to the main spindle of the headstock. The shafts carrying the gears of this drive are mounted in ball bearings. The bed, carriages and tool slides are designed to take the cutting strains without vibration and chatter, thus increasing the life of the cutting tools. Hardened alloy steel parts have been used liberally to obtain a substantial construction and large bearing surfaces on the carriages and tool slides insure long life and relative freedom from adjustment. The headstock and the clutch mechanism, as well as the feed and power traverse mechanism, are enclosed and automatically lubricated.

# Portable Power Driven Bending Machine

A POWER driven bending machine for handling pipe, reinforcement bars, square bars, round bars, angles, channels and tees has recently been placed on the market by the Wallace Supplies Manufacturing Company, Chicago. It covers a wide range of work and at the same time is sufficiently light to make it reasonably easy to transport by means of a truck from one job to another.

The machine operates in both directions, and is, therefore, suitable for making both right-hand and left-hand bends in reinforcement bars, which is a decided advantage in the bending of material of this kind. This, however, applies only to bars, as pipes, angles, channels, tees, etc., on account of the tool equipment necessary for bending such shapes, can be bent only to the one hand and in order to get a reverse bend the material has to be removed and reinserted from the opposite end.

It is equipped with a form for making a 90 deg. bend in



**Portable Power Driven Bending Machine Which Handles a Wide Range of Work**

a 4-in. diameter pipe, but more than 90 deg. bends can be obtained either by resetting the material in the form and putting it through repeated operations, or by having the machine equipped with a special form to suit the number of degrees of bend wanted.

The form is secured to the head of the machine and, therefore, becomes a rotating member in its operation. One end of the pipe to be bent is clamped to the form, which is accomplished by the use of an eccentric lever, which has its bearing against a floating block shaped to fit the pipe. This admits of easily slipping the pipe out of the clamp when the bend has been completed. In the case of a reverse bend, the fulcrum pin with the knurled top, which secures the eccentric to the clamp, is taken out in order to remove the finished S bend.

Forms can be furnished according to the specifications to make bends of any number of degrees to any radius, from a minimum of a 4-in. radius in pipe as small as 1¼-in. iron pipe size, to a maximum of 24-in. radius in pipe as large as 4-in. iron pipe size. It is also possible to increase the radius to 36 in. by altering the patterns with special attachments.

A floating follower bar is interposed between the form and the back pressure rollers to support the walls of the pipe at the point of bending and to prevent the flattening of the pipe by any direct pressure of the rollers against the wall of the pipe. The follower bar is accurately grooved to fit the pipe. The back pressure rollers are held in position by pins with extended knurled ends, which allows the rollers to be easily removed for the purpose of quickly changing over to another type of roller for special jobs when necessary.

The back pressure rollers are mounted on a movable bracket in a tapered extension slide, and can be easily moved backward and forward within a range of 24 in. to make them quickly adjustable to suit forms of various sizes of follower bars, or other tool equipment that may be needed for the bending of angles, tees, channels or special sections.

In addition to the screw adjustment, the adjusting screw nut, in which the adjusting screw operates, is fitted with two pins. The tapered slide is arranged with a series of holes so that the entire adjusting screw mechanism can be quickly moved backward and forward, and at the same time permit the placing of the nut as closely to the bracket as possible in order that it may be held rigidly.

At approximately the center of the main worm gear will be noticed a movable stop block, held in position by two set screws. This block serves as a knock-out for the clutch mechanism and can be set at any predetermined point on the flange of the large worm gear automatically to stop the machine to correspond with the number of degrees of bend that may be required. For the bending of pipes 2½ in. in diameter and under, the machine should be operated directly through the regular worm gear, which develops enough power to bend up to this size of pipe, but if pipes over 2½ in. and up to and including 4-in. iron pipe size are to be bent, the work should be done through the back gears with which this machine is equipped. The lever for throwing the back gears into service is shown at the right of the machine. Under the direct drive through the worm gear the head revolves at a speed of 4½ r.p.m., while when operating through the back gears the speed is reduced to 1¼ r.p.m.

The machine can be operated forward or reverse, and also stopped at any point by means of a lever which operates the clutch fingers of the double cone clutch mechanism. Thorough lubrication is effected by oil tubes leading to all important bearings. The worm and worm gear are enclosed so that they will run in gear grease. The floor area required is about 6½ ft. by 6 ft., and the height of the machine from the top of the floor to the top of the table is about 26 in., while the height over all is approximately 36 in.

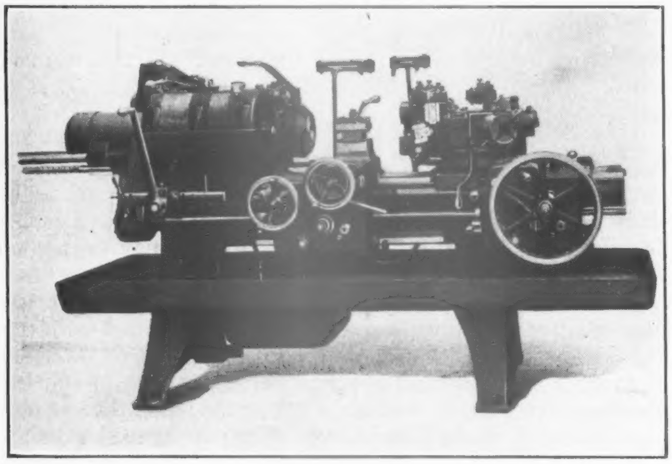
# A Universal Hollow Hexagon Turret Lathe of High Capacity

THE Warner & Swasey Company, Cleveland, Ohio, have recently placed on the market what is known as its No. 1-A universal hollow hexagon turret lathe. While similar in general type to the No. 2-A and 3-A turret lathes, this machine incorporates many improved features. It has a new design of all-steel geared head, an increased number and range of feeds, a quick method of changing feeds in the aprons of the carriages, a new patented turret binding mechanism, and new tooling.

The machine equipped for bar work is shown in the illustration. Its capacity through the automatic chuck collet is 2½ in. for round bars, with a maximum turning length of 26 in. The machine may also be equipped with a 12-in. chuck, giving a maximum swing over the carriage of 13¾ in. and over the ways of 16¾ in.

The machine is designed with the changes of feeds located in the aprons, eliminating unnecessary effort. The gears in the head are controlled by easily operated levers, reached conveniently from the position of the operator. The power rapid traverse greatly reduces the fatigue attending the hand movement of the loaded turret.

The head of the machine is cast integral with the bed



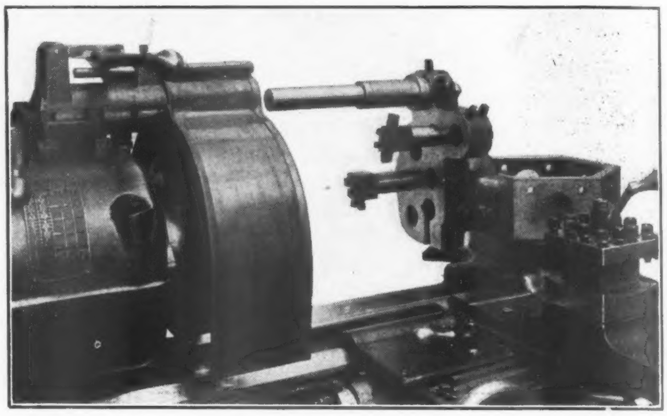
Warner & Swasey Universal Turret Lathe Equipped for Bar Work

which assures the rigidity of this member. The gears shown in one of the illustrations are substantial in proportions, are made of heat-treated steel and operate in an oil bath. The system of gearing provides 12 spindle speeds, both forward and reverse, running from 20 r.p.m. to 477 r.p.m. The wide selection of speeds is particularly useful where large and small diameters are to be turned, bored, or threaded on the same piece. Starting, stopping, and reversing the machine is accomplished through a double friction clutch on the back shaft of the machine.

Provision has been made for two arrangements of the motor drive. A motor may be mounted on the head end leg, and connected by a belt with the single pulley drive. This arrangement is furnished standard where the countershaft is omitted. Where it is required to keep within the floor space occupied by the machine itself, the motor may be mounted on the plate on the head of the machine and connected by a chain with the driving pulley.

The hollow hexagon turret is used, with broad faces to which tools and holders are bolted from the inside. This form of turret assures solid support for the tooling, and permits the use of heavy multiple cutting tools, taking several cuts at the same time. To assure accuracy of alinement, the faces of the turret are faced and bored by tools held in the spindle of the machine itself, after final installation of the turret.

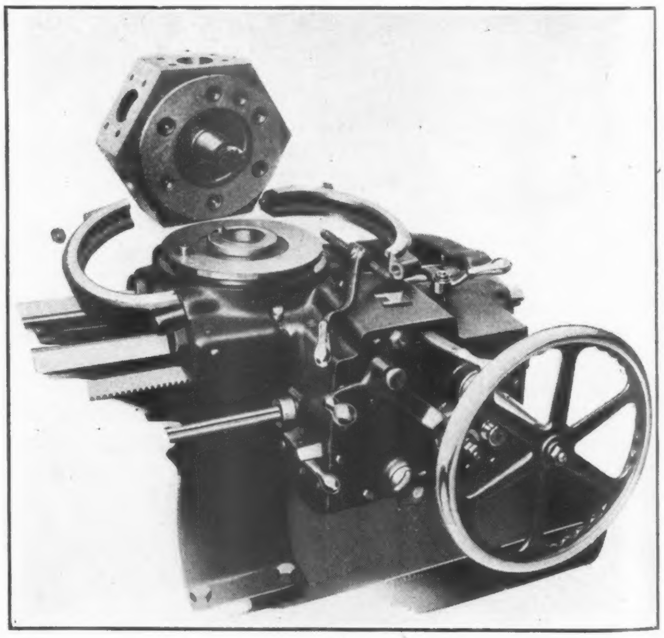
To secure rigidity of the turret under the increased feed pressure encountered in this machine, a unique patented binding mechanism has been designed. As shown in the illustration, it consists of a two-part collar with a groove of tapered section which embraces a tapered flange on the bottom of the turret and a tapered flange on the turret seat. By means of right- and left-hand screws, manipulated by a lever, the two halves of this collar are pulled together and



Turning Head with Overhead Pilot Bar

the turret bound tightly to its seat. The same lever operates the turret lockbolt.

The turret is equipped with 16 feeds, 8 of which are readily obtained by two levers located in the saddle apron itself. An additional lever operates a change gear located in the gear box at the head end of the machine, thereby making available a selection of 16 feeds from .0045 in. to .120 in. per revolution of the spindle. The location of the feed



Construction of the Turret Binding Mechanism

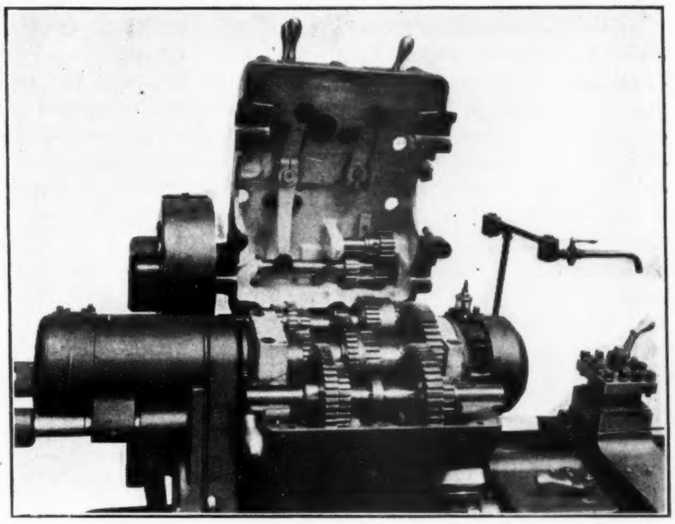
changes in the saddle apron substantially reduces the time of changing. A rapid power traverse has been provided for moving the turret to and from the working position in order

to lessen the operating effort. It can not be engaged while the turret is under feed and will automatically disengage as the turret reaches the end of the bed.

The side carriage is mounted on the front vee, and does not extend across the ways. It is gibbed to a lower dovetailed bearing on the front of the bed. This construction gives a firm support to the side carriage and provides a valuable clearance. The swing over the end of the cross slide dovetail ways is 13¾ in., and over the carriage the swing is 16 in. The entire side carriage may be moved to the left past the chuck and out of the way of the turret saddle when not in use. This gives a maximum swing over the ways of the bed of 16¾ in. The square turret is mounted on the side carriage and will hold four or more tools. It is indexed without being lifted from its seat, and may be clamped in any position by a quarter turn of the binder head.

Sixteen longitudinal and 16 cross feeds are provided for the side carriage, which may be operated independently of the turret carriage. With this wide range of feeds peripheral turning, cross facing, or recessing operations may be performed by the square turret tools at the correct feed, while the hexagon turret is engaged in drilling, boring or turning cuts at the proper feed. The cross travel of the square turret is 8¼ in. The longitudinal travel of the side carriage is 22¾ in., which may be extended to a maximum of 30½ in. by removing two of the dogs on the stop roll.

The standard equipment for both bar and chucking work is complete and flexible, so that it may be adapted to a wide range of production requirements without the use of special tools. An overhead piloted turning tool is a standard accessory of this machine. The pilot bar is held adjustably in the body of the turning head, and enters a corresponding bushing adjustably mounted on the head of the machine. The design compensates for the loss of a center pilot bar

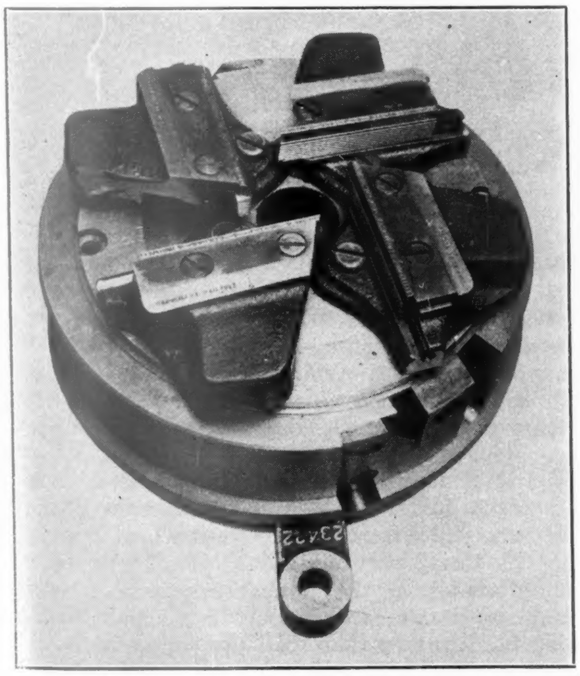


Heat Treated Steel Gears Operate in an Oil Bath in the Head of the Machine

when the latter can not be used, and greatly increases the rigidity of the machine and tools on extremely heavy work where both center and overhead pilots may be employed.

# Reverse Die Head for Cutting Taper Threads on Crown Bolts

THE Landis Machine Company, Waynesboro, Penna., has placed on the market a reverse taper die head for cutting tapered threads on crown bolts from the big end to the small end. When cutting these threads the usual



Reverse Taper Die Head for Cutting Threads on Crown Bolts, Threading from the Large to the Small End

practice is to thread from the small end to the large end. This usually causes the nicking of the body of the bolt, which makes the bolt unfit for service, or at least creates a tendency for the bolt to break at the place where it is nicked during the threading operation. The Landis die head was designed to overcome this condition.

Another important feature is that the square on the end of the crown bolt does not have to be true with the body for the die head grips the body of the bolt. The die head is furnished in the 1½-in. size only. Its diameter is 11⅞ in. and its length is 7 5/16 in. The maximum diameter of the bolt which can be threaded is 1⅞ in., while the maximum taper of thread is 2 in. per foot. The head can be applied to any Landis threading machine having a capacity of 1½ in. or more. The machine must be equipped with a lead screw attachment to insure a thread of perfect form and correct lead. A special carriage front or trip rod brackets will be required to accommodate the two trip rods which are supplied with the head.

The die head is operated by two trip rods attached to the carriage in front of the machine. These rods are fitted with adjustable nuts which engage the lugs of the yoke ring. The lugs are located diametrically opposite each other. The adjustable nuts are placed in contact with the lugs on the yoke ring when the work is about to enter the die head. As the work advances, the yoke ring is pushed back, taking with it the operating ring to which the cam shoes are attached. The cams are designed so that, as the cam shoes slide over the cams, the die head is closed gradually to correspond to the taper of the thread. A set of cams is required for each thread taper.

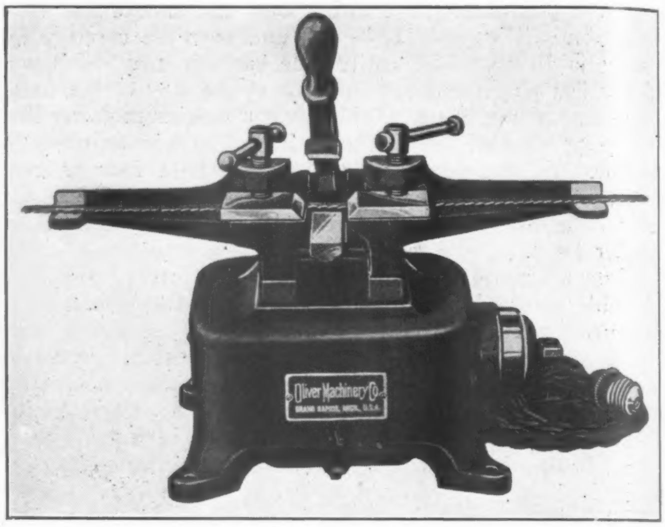
The travel of the cam shoes must equal the length of the thread. The die head opens when the crest of the cam shoe passes the crest of the cam. Stop screws are provided to limit the opening of the head which is automatically brought to the threading position as the carriage is withdrawn from the work.

# Electric Brazer for Band Saw Blades

THE Oliver Machinery Company, Grand Rapids, Mich., has recently put on the market a device for brazing band saws which utilizes the electric heat of resistances for melting down the soldering metal. This eliminates any open flame, the danger of fire, and the formation of scale on the saw blade is prevented by a sensitive control of the heat. The device comprises a transformer of which the main coil is connected to a power or light circuit through a switch, and a secondary coil which serves as a stay for both saw ends. The saw ends are bevelled to about 1/8 in. to 1/2 in. Then a strip of 1/2-in. to 3/4-in. silver solder is laid between them and the apparatus is started by turning the switch. After some seconds the brazed seam will glow and melt down the brazing metal. Besides the zero position the switch has three further steps. By every step certain windings of the secondary coil are switched in and off thus causing a stronger or a less intense heat. The switch can be regulated both backward and forward thus permitting of regulating the heat conduction during the melting period. After this, the brazing metal is distributed on both sides by means of a borax flux so as to obtain a tight connection and a clean brazed seam without any scale which is a desirable feature.

By means of the hawkbill, both saw ends to be brazed are firmly pressed together for some seconds after the brazing metal has been melted down, but this should only be done after the current has been switched off. There is no annealing of the saw blade. Too great hardness of the steel is prevented by again switching on the electric current.

The brazing process can be easily supervised by the workman, as no flames or dangerous temperatures are produced and damage to the apparatus by wrong attendance is ex-




Oliver Electric Brazer Which Can Be Used by Unskilled Workmen

cluded. It requires from six to twelve amperes for blades up to a width of two inches so that it can be connected to every alternating current feeder.

# Industrial Electric Furnace with Perforated Muffle Plates

A NEW industrial hearth-type electric furnace for operation up to 1,850 deg. F. has been recently perfected by the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. These furnaces, which are known as type B, are made with hearth sizes ranging

Electric Furnace Equipped with an Automatic Temperature Control

from 4 in. wide and 10 1/4 in. deep to 12 in. wide and 36 in. deep and are particularly well suited for such operations as annealing, hardening, tempering, normalizing, carbonizing and case hardening. Automatic temperature control makes it possible to duplicate heating conditions as often as is necessary.

One of the distinctive features of this furnace is that the muffle plates, which completely enclose the heating chamber, are perforated so that heat is radiated directly from the heating element to the charge. This unusual construction permits a higher temperature in the heating chamber without undue deterioration of the heating elements. These elements, which consist of S-bend coils of nickel-chromium wire, are placed on all four sides of the heating chamber and are supported and alined by molded studs on the muffle plates.

The door of the furnace is suspended by a chain from one point, which, being always on the circumference of an arc at the end of the operating handle, maintains a position directly over the center of the door when it is opened or closed. This method of operation prevents the door from sticking or jamming in its guides. Pieces of angle iron bolted to the guides are so adjusted that the door is held closely against the front casting when closed but can move easily when being opened.

The insulation of the furnace is arranged so that the muffle plates do not carry any of the weight. Standard insulating bricks next to the shell are supported by the high temperature insulation, which is in the form of slabs. In this way, the muffles are relieved of the weight of the insulation.

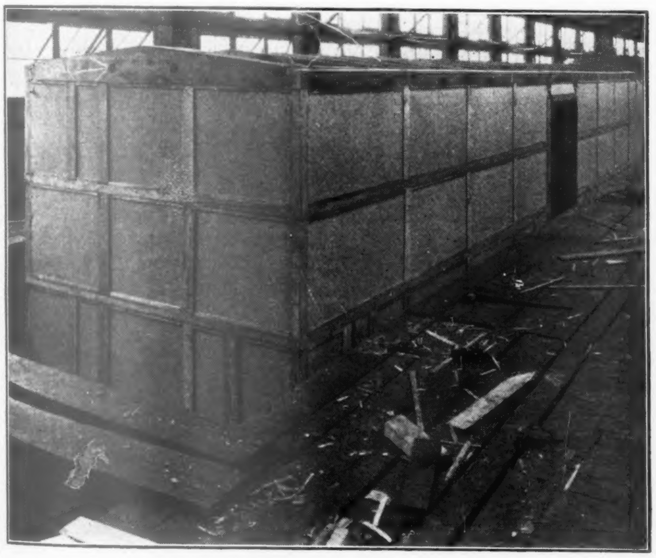
The furnace shell, or casing, is of heavy sheet steel, with the sides and bottom in one piece. The top, however, is a separate piece, to facilitate removal for the purpose of mak-

ing repairs to the insulation or heating element. The rear casting design is a frame supporting an asbestos panel through which the ends of the heating coil protrude. Heavy air cooled connectors join the coils in series and connect to the lines.

One of the advantages of the electric furnace is its automatic control, enabling the operator to maintain a desired temperature indefinitely. The automatic electric control consists of a control pyrometer, a relay and magnetic contactor. In the control instrument, a stationary pointer carrying two electric contacts is set at the desired temperature and the furnace turned on by a conveniently located push button. As the temperature rises, an indicating hand in the control instrument, actuated by a thermo-couple in the furnace chamber, moves along the scale. When it reaches the upper of the two contacts carried by the stationary pointer, the relay is energized, opening the magnetic contactors and cutting off the current. When the temperature falls to the point where the indicating hand reaches the lower of the contacts on the stationary pointer, the relay cuts the current on again. This cycle, continuing as long as the furnace is in operation, maintains the temperature within approximately one per cent of the desired point without any attention on the part of the operator.

# Insulating Lumber for Refrigerator Cars

A NEW insulating lumber, known as Celotex and developed by the Celotex Company, Chicago, is adapted to use in the building trades as sheathing, exterior finish, plaster base and roof insulation. Celotex of lighter density is also being introduced extensively in the railroad field, particularly as the insulating medium in refrigerator cars and steel cars. The adaptability and success of the material for this purpose is shown by the fact that about 20



Side Walls and Ends Insulated with Four Layers of Celotex

million sq. ft. is now in use in refrigerator cars owned by six railroads and eight car companies.

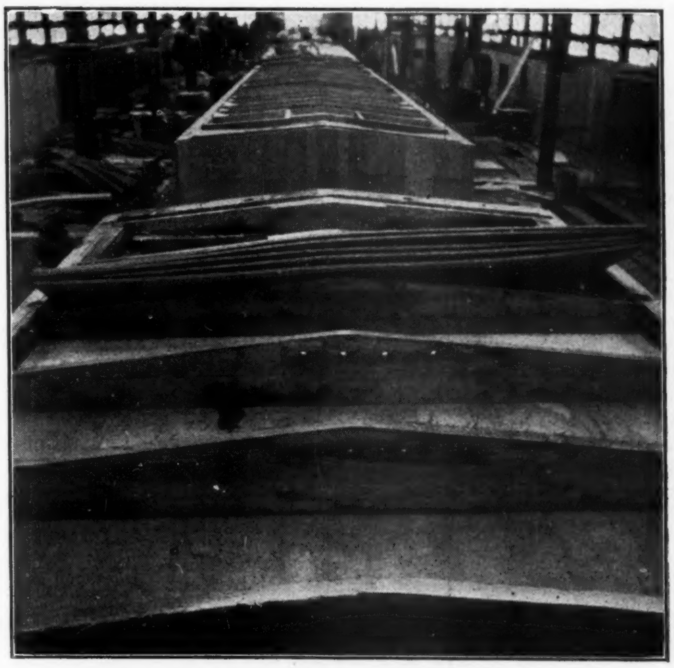
Celotex is an insulating lumber made from sugar cane fibre or bagasse, as it is called in the South. During the course of manufacture the cane fibre is firmly interlaced and felted into a strong insulating board. The strength of the material is derived solely from its structure as it does not contain any adhesive. The material comes in sheets ½ in. thick and of any size to meet the car builder's specifications.

The tensile strength of Celotex is 373 lb. per sq. in., and a board 12 in. wide, with supports 16 in. apart, will deflect 13/16 of an inch under a load of 158 lb. Tested as a sheathing material applied to studs, in comparison with ¾ in. by 6 in. yellow pine boards, Celotex shows six times as much resistance at the point of initial deflection, and nearly twice as much load at the point of failure. Heat transmission tests at the Armour Institute of Technology by the flat plate method are indicative of the insulating quality of the material. These tests are reported to have shown a conductivity of 7.91 for Celotex as compared to 7.4 for pure corkboard, 8.3 for rock cork, 10.4 for pulp board and 19 for white pine. In other words, Celotex has roughly three times the insulation value of white pine. It weighs 13 lb. per cu. ft. or only one-third as much.

When used in refrigerator cars Celotex performs two functions, providing insulation and taking the place of the blind lining. It is applied directly on the car frame and all blind lumber is omitted. The index figure 7.91 means that only .33 B.t.u.'s per sq. ft. per in. thickness per deg. F. difference in temperature will be transmitted through Celotex in one hour. Any number of layers may be applied to build up the insulation value which the car builder desires.

Celotex may be used as the sole insulating material or in combination with other materials. It is designed to be highly resistant to moisture so that it will not deteriorate even under water pressure. It is thoroughly waterproofed during the process of manufacture, assuring the maintenance of maximum efficiency in insulation during the life of the car.

An advantage of Celotex when used as floor insulation is



Celotex Used for Roof; Also Floor Insulation

the possibility of arranging the material in laminated layers one over the other, avoiding continuous joints in the floor. Further advantages of Celotex are its ease and consequent low cost of application. No special tools are required as it can be sawed like lumber.

# GENERAL NEWS

The Supreme Court of the United States on October 27 again refused to review the case of former employees of the Atchison, Topeka & Santa Fe who were convicted of criminal conspiracy to obstruct the mails and interfere with interstate commerce after having suddenly gone on strike at Needles, Calif., at the time of the shopmen's strike in 1922, leaving passengers stranded in extremely hot weather. On October 13 the court had declined to review the case, but an application was filed for a reconsideration.

### Simplification of Steel Lockers

Following an extended study of the sizes and varieties of steel lockers and as a sequel to a meeting of manufacturers held in February, 1923, the Division of Simplified Practice of the Department of Commerce, Washington, will hold a conference of manufacturers, distributers and users of this equipment on November 19 to consider the elimination of excess varieties. The tentative recommendations for the standard sizes to be retained provide for three widths, four depths and four heights. The practicability of including compartment and multiple tier steel lockers in these recommendations will be also acted upon by the conference.

### Germany Claims World's Fastest Freight Train

The distinction of having the world's fastest freight train is claimed by the German railways. The train is composed of twenty cars of a new type, each of fifty tons' capacity, and although its weight is practically double that of a standard express train it can, from full speed of about 100 kilometers (approximately 62½ miles) per hour, be stopped at a braking distance of only about 3,300 ft. This performance is rendered possible by the design of the cars and locomotive, by the use of specially designed high-speed pneumatic brakes, and, finally, by the use of automatic couplers.

### Letter Ballot on Standard Box Cars

The American Railway Association has issued Circular No. DV-376 giving the results of the second letter ballot on standard box cars. The board of directors has approved propositions five, seven and eight containing the recommendations of the Mechanical Division as to the standard single-sheathed box car and the types W and Y trucks, including bolsters, side frames and other details. In the case of proposition six relating to the standard double-sheathed steel box car, in order to obtain interchangeability of roofs and the maximum of standardization with details already incorporated in the single-sheathed car, it was the opinion of a majority of the General Committee that this car should be designed to an inside width of 8 ft. 9⅛ in. The General Committee, however, was unable to agree upon a unanimous recommendation. Proposition six will be given further consideration by the Car Construction Committee and the General Committee and a ballot considered later.

### The Santa Fe's Reserve Corps, U. S. A.

Under the plan of the United States War Department to form a number of railroad battalions as part of the organized reserved corps of the army, the 612th Engineer Battalion has been allocated to the Atchison, Topeka & Santa Fe, and the personnel will be drawn from employees on lines between Chicago and Denver, Colo., Purcell, Okla., and Waynoka, Okla. The battalion consists of four parts, the first being the battalion headquarters and headquarters platoon; the second, a maintenance of way company, or company A; the third, a maintenance of equipment company, or company B; and the fourth, an operating company, or company C. Men have been selected for commissioned officers and an effort is being made to secure men for non-commissioned officers and privates to fill these companies. Enlistment in the organization does not obligate a man in such a manner as to interfere with his business or vocation in normal times. This battalion will function only in times of war with a major power and cannot be called into service for local disturbances such as riots or strikes.

### Trial by Jury in Contempt Cases Arising Out of Labor Injunctions

The United States Supreme Court, in a decision rendered on October 20, upheld the provision of the Clayton law which provides for a trial by jury in contempt cases arising from violations of court injunctions in connection with labor disputes. In this it reversed the seventh circuit court of appeals which had affirmed a decision of the United States court for the western district of Wisconsin in the case of striking shop employees of the Chicago, St. Paul, Minneapolis & Omaha, who had been sentenced for contempt for violation of an injunction issued by the court by conspiring to interfere with interstate commerce. The lower court had held that while on strike the men were not "employees" within the meaning of the law. The Supreme Court, in the opinion by Justice Sutherland, held that they were "employees" within the meaning of the law and that it was not necessary for this purpose that the old status of employer and employee should exist at the time the alleged contempt was committed to make the jury trial provision of the law effective.

### Canadian Unions Protest Against Claim That Wages Are Too High

Railway men's unions throughout Canada have joined in a protest to the Dominion Railway Board against statements made in the recent application of the Tudhope Anderson Company of Winnipeg and Orillia, Ont., which firm in urging decreased freight rates took the ground that wages paid to railway employees were unreasonably high, unfair and extravagant. The railway men's memorial declares these statements to be untrue, and assumes that the Railway Board will not attempt to interfere in matters outside its jurisdiction.

Negotiations between the Canadian National Railways and conductors and trainmen employed on that road in respect to wages and conditions have been postponed subject to reopening upon intimation by the men of a desire to resume. The negotiations opened in February last following a demand from the men that a similar settlement to that recently put into force on the New York Central and other United States lines should become operative on the Canadian National.

### Fuel Consumption on the M. P.

Fuel consumption on the Missouri Pacific during July was .9 of a gallon per car mile in passenger service and 9.6 gal. per thousand gross ton-miles in freight service. A record has been kept of each district in each class of service showing the gallons consumed per passenger car-mile and per thousand gross ton-mile including all the fuel used in through and local passenger service, through and local freight mixed trains, traveling switch and light engines running for the benefit of freight and consumption at all terminals. The St. Louis district coal burning engine in passenger car service averaged 12.6 lb. per passenger car-mile equivalent to one gallon of oil per car-mile. Coal burning engines in freight service averaged 96 lb. per thousand gross ton-mile equivalent to 7.6 gal. of oil. In passenger service the McAlester district ranked first among the districts with .8 gal. per car-mile and 8.7 cars per train. In the freight service the McAlester district also ranked first with 7.7 gallons per thousand gross ton-mile and 2,276 average tons per train. In yard service the North Texas district ranked first, having used 9.4 gal. per engine-mile. Among the unusual economical consumptions during August an engine on an excursion from Waco, Tex., to Galveston with 12 cars consumed 2,025 gal. of oil in making 3,456 passenger car-miles or .58 gal. per car-mile. Another engine in June burned 7,509 gallons of oil, making 9,124 car-miles or .8 gal. per car-

mile. In July the same fireman used 5,813 gal. making 6,751 car-miles or .8 gallon per car-mile and in yard service in August he used 8.3 gal. per engine-mile. On August 23 a crew handled 1,802 tons from Smithville, Tex., to New Ulm, 3,408 tons from New Ulm to Houston, a total of 70 miles or 319,560 gross ton-miles on 1,256 gal. of oil or four gallons per one thousand gross ton-miles. The run was made in 7 hrs. 35 mins., taking water twice, 16 in. of water being in the tank on arrival at Houston.

## Valuable Show Horses Are Burned in Express Car

Eight valuable show horses were burned to death or injured so seriously that they had to be shot and four men came near losing their lives when an American Railway Express car, attached to train No. 82, of the New York Central, caught fire, Friday, October 10, when approaching Dunkirk, New York. The horses, which were valued at $18,000, were en route from their stables in Cleveland, Ohio, to the Madison Square Gardens, New York. They were in charge of four caretakers who were riding in the car at the time it caught fire.

The car was of wooden construction and was placed first in the train next to the locomotive. It is presumed that the fire started from a spark alighting in the straw which covered the floor. This, however, could not definitely be determined. It was declared by the caretakers that there was no means of signaling the engine-man and all that they could do was to fight the fire and wait for the train to stop, which was at Dunkirk. A by-stander at the Union Station at Dunkirk, seeing that the car was in flames turned in an alarm and both the Dunkirk fire and police departments responded. One of the horses jumped from the car at the Central avenue crossing in Dunkirk and broke its leg, necessitating the shooting of the animal. Another horse succeeded in jumping safely from the car at Deer street crossing and it is reported that he will recover. The remaining six horses had to be shot.

### FREIGHT CAR REPAIR SITUATION

| 1924 | Number freight cars on line | Cars awaiting repairs: Heavy | Light | Total | Per cent of cars awaiting repairs |
|---|---|---|---|---|---|
| January 1 | 2,279,363 | 118,653 | 39,522 | 158,175 | 6.9 |
| February 1 | 2,269,230 | 115,831 | 45,738 | 161,569 | 7.1 |
| March 1 | 2,262,254 | 119,505 | 49,277 | 168,782 | 7.5 |
| April 1 | 2,274,750 | 125,932 | 46,815 | 172,747 | 7.6 |
| May 1 | 2,271,638 | 131,609 | 47,666 | 179,275 | 7.9 |
| June 1 | 2,280,295 | 138,536 | 50,683 | 189,219 | 8.3 |
| July 1 | 2,279,826 | 144,912 | 49,957 | 194,869 | 8.5 |
| August 1 | 2,278,773 | 153,725 | 49,139 | 202,864 | 8.9 |
| September 1 | 2,296,589 | 158,200 | 51,909 | 210,109 | 9.2 |
| October 1 | 2,304,020 | 157,455 | 48,589 | 206,044 | 8.9 |

| Month | Cars repaired: Heavy | Light | Total |
|---|---|---|---|
| December | 87,758 | 2,073,280 | 2,161,038 |
| January | 76,704 | 2,083,583 | 2,160,287 |
| February | 70,056 | 2,134,781 | 2,204,837 |
| March | 77,365 | 2,213,158 | 2,290,523 |
| April | 75,352 | 2,074,629 | 2,149,981 |
| May | 73,646 | 2,130,284 | 2,203,930 |
| June | 70,480 | 1,888,899 | 1,959,379 |
| July | 72,347 | 1,567,430 | 1,639,777 |
| August | 71,863 | 1,420,482 | 1,492,345 |
| September | 74,295 | 1,372,277 | 1,446,572 |

PASSENGER CARS ORDERED, INSTALLED AND RETIRED

| Quarter | No. installed during quarter | No. retired from service during quarter | No. owned or leased at end of quarter |
|---|---|---|---|
| Jan.-March | 792 | 679 | 54,370 |
| April-June | 513 | 555 | 54,328 |
| July-Sept. | 553 | 531 | 54,349 |
| Oct.-Dec. | 861 | 948 | 54,262 |
| Full year, 1923 | 2,719 | 2,713 | ...... |
| 1924 | | | |
| Jan.-March | 609 | [illegible] | 54,519 |
| April-June | 698 | [illegible] | 54,668 |

Figures cover Class I roads reporting to Car Service Division.

## Number of Three-Cylinder Locomotives Increasing

An order has recently been placed by the Lehigh Valley with the American Locomotive Company for five three-cylinder locomotives, duplicates of the original No. 5000 type, which was on exhibition at the Atlantic City convention of the American Railway Association. This company has also recently announced an order from the Wabash for 50 Mikado type locomotives, five of which are to be of the new three-cylinder type. The Delaware, Lackawanna & Western has placed an order with this company for two three-cylinder Mountain type locomotives. At present there are three-cylinder locomotives in operation on or under construction for the Lehigh Valley, the New York Central, the New York, New Haven & Hartford, the Missouri Pacific and the Wabash. Five locomotives of the three-cylinder type were recently shipped to South Manchuria. Additional statistics show that there are in operation or under construction in England over 250 locomotives of this type, approximately 2,100 in Germany, as well as many others in Sweden, Switzerland, Brazil and the Argentine Republic.

## Southern Pacific Orders 4-10-2 Type Locomotive

The American Locomotive Company has announced the receipt of an order for a three-cylinder locomotive from the Southern Pacific. One of the features is the unusual wheel arrangement which might be considered as an evolution of the Mastodon 4-10-0 type locomotive. The design of the new locomotives includes a set of trailer wheels, which gives it a 4-10-2 wheel arrangement, which is the first of this type ever built in the United States. It will be known as the Southern Pacific type. It is claimed that this locomotive will be the largest and the most powerful articulated locomotive in the world. Some of the principal dimensions and weights are as follows:

| | |
|---|---|
| Railroad | Southern Pacific |
| Builder | American Locomotive Company |
| Type of locomotive | 4-10-2 |
| Cylinders, diameter and stroke: | |
| Two outside | 25 in. by 32 in. |
| One inside | 25 in. by 28 in. |
| Weights in working order: | |
| On drivers | 310,000 lb. |
| Total engine | 438,000 lb. |
| Driving wheels, diameter outside tires | 63½ in. |
| Boiler steam pressure | 225 lb. |
| Tender: | |
| Water capacity | 12,000 gal. |
| Fuel capacity | 4,000 gal. oil |

## Labor News

ENGINEMEN'S BROTHERHOOD MINES HAVE TROUBLE WITH UNION EMPLOYEES.—The Coal River Collieries Company, which operates coal mines in West Virginia and Kentucky and is owned by members of the Brotherhood of Locomotive Engineers, has refused to sign a wage agreement with the United Mine Workers of America because it cannot earn its expenses while operating under the union scale of wages, according to Warren S. Stone, chairman of the brotherhood and of the board of directors of the coal company. The brotherhood members closed down their mine rather than pay the wages demanded by the union. This action brought a strong letter of protest to Mr. Stone from John L. Lewis, president of the Mine Workers' Union, declaring that the brotherhood's company has assumed the same attitude as other operators in the field.

"This is an intolerable position for a coal company whose stock is largely owned and whose affairs are directed by union men, to occupy," Mr. Lewis said.

In reply, Mr. Stone declared that "the members of the Brotherhood of Locomotive Engineers who have invested over $3,000,000 in these properties are entitled to some return on their investment and I think you will concede this; yet at the present price at which

### LOCOMOTIVE REPAIR SITUATION—NEW METHOD OF COMPILATION

| Date, 1924 | No. locomotives on line | No. serviceable | No. stored serviceable | No. req. classified repairs | Per cent | No. req. running repairs | Per cent | Total req. repairs | Per cent |
|---|---|---|---|---|---|---|---|---|---|
| February 1 | *64,377 | 53,586 | 4,116 | 5,919 | 9.2 | 4,872 | 7.6 | 10,791 | 16.8 |
| March 1 | 64,431 | 53,127 | 3,800 | 6,047 | 9.4 | 5,257 | 8.1 | 11,304 | 17.5 |
| April 1 | 64,363 | 52,805 | 4,648 | 6,128 | 9.5 | 5,430 | 8.4 | 11,558 | 17.9 |
| May 1 | 64,330 | 52,899 | 6,079 | 6,105 | 9.5 | 5,335 | 8.3 | 11,440 | 17.8 |
| June 1 | 64,373 | 53,498 | 6,661 | 6,099 | 9.5 | 4,776 | 7.4 | 10,875 | 16.9 |
| July 1 | 64,416 | 53,382 | 7,117 | 6,035 | 9.4 | 4,999 | 7.7 | 11,034 | 17.1 |
| August 1 | 64,486 | 53,381 | 7,152 | 6,073 | 9.4 | 5,032 | 7.8 | 11,105 | 17.2 |
| September 1 | 64,582 | 53,618 | 6,762 | 6,023 | 9.3 | 4,941 | 7.7 | 10,964 | 17.0 |
| October 1 | 64,538 | 53,209 | 5,424 | 6,175 | 9.6 | 5,154 | 8.0 | 11,329 | 17.6 |

coal is selling and the cost of mining under the Jacksonville agreement it is impossible for the union mines to break even."

**Brotherhood Wage Negotiations.**—The anticipated test of the powers of the United States Railroad Labor Board under the Transportation Act was begun in Chicago on September 29 when a petition was filed with the United States District Court by the Labor Board, asking that John McGuire, general chairman of the Brotherhood of Locomotive Engineers on the Chicago & North Western, and O. B. Robertson, president of the Brotherhood of Locomotive Firemen & Enginemen, be compelled to testify before the board. The two defendants in the present case, as well as a number of other brotherhood officials, had twice ignored subpoenas of the Labor Board to appear and testify in the controversy with the western railways over proposed changes in wages and working rules.

The petition was filed before Federal Judge James H. Wilkerson by Edwin A. Olson, United States attorney, and Weymouth Kirkland and Robert N. Golding, special assistants to the United States attorney general. Mr. Kirkland opened arguments before Judge Wilkerson on October 21.

Donald R. Richberg, counsel for the brotherhoods, declared that the statement of facts in the Labor Board's petition was incorrect and that the defendants would therefore not move for dismissal, since such a motion would entail acquiescence in the statement of facts, but would file an answer, setting forth their version of the facts of the dispute.

## MEETINGS AND CONVENTIONS

### International Railway Congress at London

The next congress of the International Railway Congress Association will be held in London from June 22 to July 6, 1925. Besides the regular business, the congress will make a number of excursions to places of railway interest in Great Britain—among them the Swindon works of the Great Western Railway, Darlington (where the centennial of British railways will be celebrated), Windsor, Canterbury, Edinborough, Glasgow and the great Clyde industrial district. The chairman of the arrangements committee is Sir Evelyn Cecil, G. B. E., director of the Southern Railway, 2, Cadogan Square, London, S. W. 1.

### Chicago Car Foremen Elect Officers

At the annual meeting of the Car Foremen's Association of Chicago, held at the Hotel Morrison on Monday evening, October 13, the following officers were elected for the year 1924-25: President, Alfred Herbster, district general foreman, New York Central, Chicago, Ill.; first vice-president, J. E. Mehan, assistant master car builder, Chicago, Milwaukee & St. Paul, Milwaukee, Wis.; second vice-president, E. H. Wood, car foreman, Michigan Central, Chicago. F. C. Schultz, chief interchange inspector, Chicago Car Interchange Bureau, was re-elected treasurer. Aaron Kline, who has served the association faithfully as a secretary for 25 years, was also re-elected to the position of secretary.

### National Safety Congress Meets at Louisville

The National Safety Congress, comprising those representatives of steam and electric railroads and of other industries and associations who are engaged directly or indirectly in the promotion of the health and safety of the public and of employees, held its thirteenth annual congress at Louisville, Ky., on September 29 to October 3, inclusive, at which time an extensive program of addresses, reports and exhibits on safety work was made available to those present.

Over 100 were present at the first session of the Steam Railroad Section which was held in the Seelbach Hotel on Tuesday morning, where Henry Bruere, a member of the board of directors of the Chicago, Rock Island & Pacific, and winner of the recent Railway Age contest on co-operation between railways and their employees, delivered an address on better management through co-operation, which was followed by a paper on the development of safety on the railroads by Charles Frederick Carter, author of "When Railroads Were New." Other sessions of the Section were held on Wednesday and Thursday morning, when papers were presented and discussions held on special railroad safety problems and work. These discussions were devoted in large part to getting the viewpoint of officers engaged directly in the work of the departments considered.

The officers of this Section are as follows: Chairman, Fred M. Metcalfe, superintendent of safety, Northern Pacific; vice-chairman, Charles E. Hill, general safety agent, New York Central; and secretary, E. R. Cott of the Hocking Valley. The election of officers for the ensuing year resulted in the choice of Charles E. Hill for chairman, and for vice-chairman and secretary, A. V. Rohweder of the Duluth, Missabe & Northern, and E. G. Newman of the Union Pacific, respectively.

*The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:*

Air-Brake Association.—F. M. Nellis, Room, 3014, 165 Broadway, New York City.

American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association.—C. Borcherdt, 202 North Hamlin ave., Chicago.

American Railway Association, Division V.—Mechanical.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

Division V.—Equipment Painting Division.—V. R. Hawthorne, Chicago.

Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey St., New York.

American Railway Tool Foreman's Association.—G. G. Macina, 11402 Calumet ave., Chicago.

American Society of Mechanical Engineers—Calvin W. Rice, 29 W. Thirty-ninth street, New York. Annual meeting December 1-4, 29 W. Thirty-ninth street. Railroad Division, A. F. Stuebing, Bradford Corp., 23 West Forty-third street, New York. Meeting December 2, 2:00 p. m.

American Society for Steel Treating.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting October 20-24, Hotel La Salle, Chicago.

Canadian Railway Club.—C. R. Crook, 129 Sharron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting November 11. Paper on The Yardmaster—His Duties and Problems, will be read by T. Collins, superintendent terminals, Canadian Pacific, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 626 N. Pine ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Association of St. Louis.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

Central Railway Club.—H. D. Vought, 26 Cortlandt street, New York, N. Y. Regular meetings second Thursday, January to November. Interim meetings second Thursday, February, April, June, Hotel Statler, Buffalo, N. Y. Next meeting November 14. Paper on What a Railroad Club means to its Members, will be presented by R. V. Wright, managing editor, *Railway Age*.

Chief Interchange Car Inspectors' and Car Foremen's Association.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

Cincinnati Railway Club.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November. Next meeting November 12. Illustrated lecture.

Cleveland Steam Railway Club.—F. L. Frericks, 14416 Adler ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland, Public Square, Cleveland. Next meeting November 3. Paper on Problems of Supervision will be presented by D. C. Buell, director Railway Educational Bureau, Omaha, Neb. At the December meeting W. H. Davis, service engineer, Universal Packing Company, will speak on Practical Lubrication of Railroad Equipment.

International Railroad Master Blacksmiths' Association.—W. J. Mayer, Michigan Central 2347 Clark ave., Detroit, Mich.

International Railway Fuel Association.—J. B. Hutchinson, 6000 Michigan ave., Chicago, Ill.

International Railway General Foreman's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Master Boiler Makers' Association.—Harry D. Vought, 26 Cortlandt street, New York, N. Y.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass. Next meeting November 10. Paper on Safety on Interstate Commerce Commission will be read by A. G. Pack, chief inspector, Interstate Commerce Commission.

New York Railroad Club.—H. D. Vought, 26 Cortlandt street, New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth street, New York. Next meeting November 21. Paper on the Articulated Car will be presented by William G. Gove, superintendent equipment, Brooklyn-Manhattan Transit Lines.

Niagara Frontier Car Men's Association.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

Pacific Railway Club.—W. S. Wollner, 64 Pine street, San Francisco, Cal. Regular meetings second Thursday in month, alternately in San Francisco and Oakland, Cal.

Railway Club of Greenville.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 515 Grandview ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings second Friday in month, except June, July and August. Next meeting November 14. Paper on The Steam Locomotive with Special Reference to Three Cylinder Type, will be presented by J. G. Blunt, American Locomotive Company. Illustrated by stereopticon.

Southeastern Carmen's Interchange Association.—J. E. Rubley, Southern railway shops, Atlanta, Ga.

Traveling Engineer's Association.—W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

Western Railway Club.—Bruce V. Crandall, 138 West Madison street, Chicago. Meetings third Monday in each month, except June, July and August.

# SUPPLY TRADE NOTES

The Stafford Roller Bearing Car Truck Corporation, Lawton, Mich., has been purchased by J. S. Stearns, Ludington, Mich.

The Whiting Corporation, Harvey, Ill., has moved its Detroit office from 3000 Grand River avenue to 650 Baltimore avenue west.

The Superheater Company, New York, is preparing plans for the construction of a one-story power house at East Chicago, Ind.

The Globe Railway Equipment Company has been organized in St. Louis, Mo., to manufacture railway specialties among which is a car door hanger.

Carl J. Mellin, for many years consulting engineer of the American Locomotive Company, died at his home at Schenectady, N. Y., October 15. Mr. Mellin was born in Westergotland, Sweden, on February 17, 1851. He received his education at Alingsos and Gothenberg, Sweden. At the age of 19 he entered the Swedish State Railway shops, and three years later became a draftsman with the Gothenberg Marine Engine Works. In 1877 Mr. Mellin removed to Scotland, where he became connected with the Robert Napier & Sons Marine Works, remaining there until 1880, when he returned to Sweden, serving as superintendent and mechanical engineer of Thorskag & Eriksbergs Marine & Shipbuilding Co. In 1887 he came to America and served in New York City as designer for the Dynamite Gun Co., taking an active part in the development of designs for the cruiser *Vesuvius*, and later he went as mechanical engineer with the Richmond Locomotive Works. While in Richmond Mr. Mellin had charge of the design and construction of the machinery for the U. S. Battleship *Texas*, and he developed the system of locomotive compound cylinders which became known as the Richmond compound and which has been used extensively on domestic and foreign railways. In 1894 he became chief engineer of the Richmond works, retaining this position until the formation of the American Locomotive Company in 1901. In 1902 Mr. Mellin went to Schenectady as consulting engineer, which position he held until the time of his death. Among important designs promoted by Mr. Mellin were the articulated compound locomotive, the adaptation of the Walschaert valve motion to American conditions, the first successful power reverse gear and several types of superheater. Over fifty patents were assigned to him, chiefly for locomotive details. He was an active advocate of the use of three-cylinder locomotives, and at the time of his last illness he was engaged in designing a three-cylinder compound engine. Mr. Mellin traveled extensively in Europe and America in the interest of naval and railway engineering, and because of his service in the engineering field he was knighted and decorated by the late King Oscar of Sweden.

C. J. Mellin

Karl Kendig, advertising manager of the Whitman & Barnes Company, Akron, Ohio, has been advanced to the position of secretary of the company.

J. M. Robb, 929 Monadnock building, Chicago, has been appointed representative in that territory of the Economy Railway Appliance Company, Ltd., Montreal.

Walter C. Doering, representative at St. Louis, Mo., of the Bradford Corporation, New York, has been appointed vice-president in charge of the St. Louis office and of its business in the southwest territory.

The Pullman Car & Manufacturing Corporation has asked bids for the construction of a one-story, 280 by 484 ft., passenger car finishing plant at Pullman, Ill., to cost $500,000.

The Mid-Continent Tank Car Company, Coffeyville, Kans., will construct a branch plant for building and repairing tank cars on a 22-acre site recently purchased at Shreveport, La.

The General American Tank Car Corporation plans the construction of a plant on a tract of 230 acres at Good Hope station on the Yazoo & Mississippi Valley near New Orleans, La.

The Standard Railway Equipment Company and the Union Metal Products Company have moved their Chicago office to room 1422 Strauss building, 310 South Michigan avenue, Chicago.

L. G. Pritz, vice-president of the Sizer Steel Corporation, Buffalo, N. Y., has been appointed vice-president in charge of all operations of the United Alloy Steel Corporation, Canton, Ohio.

The Conveyors Corporation of America, Chicago, has appointed the W. P. MacKenzie Company, 1234 Callowhill street, Philadelphia, Pa., as its sales representative in southeastern Pennsylvania and southern New Jersey.

C. M. Hannaford, American National Bank building, Richmond, Va., has been appointed representative in that territory for the Locomotive Firebox Company, Chicago, manufacturers of the Nicholson Thermic syphon.

A. J. Pizzini, president of the Railway Improvement Company, New York, has also been elected president of the Waugh Equipment Company, instead of A. J. Tizzini, as was reported in the October issue of the *Railway Mechanical Engineer*.

Michael H. Connelly, formerly sales agent for the American Car & Foundry Co., has resigned to become manager of sales for the Albany Car Wheel Company; the Reading Car Wheel Company and the General Steel Casting & Machine Co., with office at 8 Lister avenue, Newark, N. J.

## W. A. Garrett

Major W. A. Garrett, general transportation manager of the Baldwin Locomotive Works, Philadelphia, Pa., died on October 10 at his home in Moylan, Pa. William A. Garrett was born on August 18, 1861, at Canton, Miss. He entered railway service in 1876 as a messenger in a ticket office on the Ohio & Mississippi Central. He then went to the St. Louis Union Depot Company, where he worked his way up through various departments to the position of assistant superintendent. From March, 1893, to January, 1896, he was superintendent of the Terminal Railroad Association of St. Louis and terminal superintendent of the Wabash; also for the last two years of this period, superintendent of the St. Louis Merchants' Bridge Terminal Railway. He then severed his connection with the Terminal and was appointed superintendent of the Western division of the Wabash, later serving on the Middle division of the same road. In August, 1899, he was appointed superintendent of the Philadelphia division of the Philadelphia & Reading, later going to the New York division; and in March, 1902, was promoted to general superintendent. The following May he was appointed general manager of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern. From December, 1906, to March, 1907, he was vice-president of the Seaboard Air Line and then to October, 1909, was president of the same road. Major Garrett served from October, 1911, to September, 1912, as chairman of the General Managers' Association of Chicago and the Association of Western Railways. From September, 1912, to

W. A. Garrett

1913, he was vice-president of the Chicago Great Western and then served as chief executive officer to the receivers of the Pere Marquette. In 1914 he made a special study for presidents of lines terminating at Chicago, and in 1917 a special study of French railways for the United States War Department. He acquired his military title when he went to France as major of engineers in the army. He spent four months abroad with three other members of a commission and submitted a report to the War Department at Washington, on which were based the plans for transportation of American troops and supplies. From May, 1915, to December, 1918, he was assistant general manager of the Remington Arms Company at Eddystone, Pa., leaving that work to enter the service of the Baldwin Locomotive Works on January 1, 1919, where he served as general transportation manager until the time of his death.

## Henry R. Towne

Henry R. Towne, chairman of the board of directors of the Yale & Towne Manufacturing Co., Stamford, Conn., died on October 15 at his home in New York. Mr. Towne was born in Philadelphia, Pa., on August 28, 1844. He attended the University of Pennsylvania but left before graduation, receiving, however, the honorary degree of M.A. in 1887. He first served in the drafting room of the Port Richmond Iron Works at Philadelphia. In 1866 he made an extensive tour of the leading engineering establishments in Great Britain, Belgium and France, and took a special course in physics at the Sorbonne, Paris. After returning to the United States he worked for some time in the shops of William Sellers & Co., Philadelphia. In October, 1868, he formed a partnership with Linus Yale, Jr., with Mr. Yale as president, and the Yale Lock Manufacturing Company was established at Stamford, Conn. Mr. Yale died shortly after, and in 1869 Mr. Towne became the president of the company, which at that time had a factory with 30 employees at Stamford and a sales room in New York. Mr. Towne continued as president until March, 1915, when he desired to retire from the duties of that office and was elected chairman of the board. During the earlier years of the company's existence Mr. Towne actively directed both the manufacturing and commercial sides of the business, but as the volume increased he devoted more and more of his time to the latter. The company at first made bank locks and the Yale pin tumbler locks. Later there were added safe deposit locks, mortise locks, Yale time lock, etc. The company also had an important business in complete post office equipments. A bronze department was added in 1873, and in 1882 it established an art department. The company secured the American rights for the Weston differential pulley block. It was also one of the first in America to build cranes, but the crane business was later sold to the Brown Hoisting Machinery Company, Cleveland, Ohio. The name of the company was changed in 1883 to the Yale & Towne Manufacturing Company. In 1878 the company absorbed the United States Lock Company and the American Lock Company; in 1894 the Branford Lock Works and in 1895 the Blount Manufacturing Company, in each case adding new lines. Mr. Towne was an active member of the American Society of Mechanical Engineers for many years and served as its president in 1888 and 1889. He had also been active in the affairs of the Merchants' Association of New York and had been its president from 1907 to 1913, and he had also served as treasurer of the National Tariff Commission Association.

H. R. Towne

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William M. Ryan, president of the Youngstown Steel Car Company, Niles, Ohio, has resigned following his election as president of the Ryan Car Company, Chicago, as reported in the October issue of the *Railway Mechanical Engineer*. R. D. Bartlett, assistant to the president, has been promoted to vice-president, and Reginald Cooke, general manager, has been promoted to secretary and treasurer.

The Beaudry Company, Inc., is now occupying its new factory at Revere Beach Parkway, Everett, Mass. The main building, which is of concrete and steel sash construction, is 140 ft. by 70 ft. The center bay has about 30 ft. of head room and is served by an electric traveling crane. The side bays are somewhat lower and have a balcony for lighter machine work and storage, giving a total floor area of about 16,000 ft.

L. B. MacKenzie, one of the founders of the Railway Electrical Engineer, died suddenly in Chicago recently. Mr. MacKenzie was formerly also the owner of the Signal Engineer, now known as Railway Signaling and published by the Simmons-Boardman Publishing Company. He had been identified with the publication business for a number of years and at the time of his death was president and editor of the Welding Engineer, a paper devoted to the field of autogenous welding.

The Premier Staybolt Company, Pittsburgh, Pa., has appointed James C. Barr, district representative in New England, with headquarters at 84 State street, Boston, Mass. J. P. Armstrong has been appointed district representative on the Pacific coast, to succeed E. F. Boyle, deceased; Mr. Armstrong's headquarters are in the Hobart building, San Francisco, Cal., and C. E. Fuller, Jr., has been appointed representative in the Rocky Mountain district with office in the Barth building, Denver, Colo.

The Detroit Machine Tool Company, Detroit, Mich., manufacturers of centerless grinding machines, has been consolidated with the Norton Company, Worcester, Mass., manufacturers of grinding wheels and grinding machines. No change has been made in the business policy of the Detroit Machine Tool Company. Harold W. Holmes will continue as president and general manager and the following officers and directors of the Norton Company have been added to the board of directors of the Detroit Machine Tool Company: Clifford S. Anderson, vice-president, Henry Duckworth, treasurer, William LaCoste Neilson and Aldus C. Higgins.

Charles A. Carscadin, general sales manager of the Bradford Corporation, with headquarters at Chicago, died suddenly on October 8 at San Francisco, Calif. He was born in Buffalo, N. Y., and entered railway service in 1881 as a stenographer in the employ of the New York Central & Hudson River, now the New York Central, at New York, which position he held until 1882 when he left to become stenographer and secretary to the president of the Michigan Central at Detroit, Mich. From 1887 to 1902 he was a traffic representative of the same road. From the latter date until the present time he was engaged in the railway supply business, having been connected with the Detroit Seamless Tube Company, the Globe Seamless Tube Company and the National Car Equipment Company. He was elected a vice-president of the Joliet Railway Supply Company in October, 1917, which position he held until July, 1922, when he was made vice-president of sales. In November, 1923, upon the organization of the Bradford Corporation, he was elected general sales manager, which position he has held until his death.

George W. Lyndon, president of the Association of Manufacturers of Chilled Car Wheels, died in Chicago on October 7. Mr. Lyndon was born at Rochester, N. Y., on February 16, 1859. After graduating from high school in 1877 he studied law with Charles K. Ladd, Kewanee and Turner A. Gill at Kansas City, Mo., until 1880 when he entered railway service with the Kansas Pacific at Kansas City, Mo. Shortly thereafter he was transferred to Omaha, Nebr., on account of the consolidation of the Kansas Pacific with the Union Pacific. He remained with the Union Pacific as chief clerk of freight accounts until 1885 when he became traveling auditor of the Kansas City, Ft. Smith & Memphis, with headquarters at Kansas City. In 1887 he was appointed freight auditor, resigning in 1889 to accept a position as freight auditor of the Chicago, Kansas City & St. Paul, now a part of the Chicago Great Western. In 1890 he resigned to become general auditor of the Griffin Wheel Company and the Ajax Forge Company. Later he was made manager of the improvement and review department of these companies, which position he held until 1907. In 1908 he was made western secretary of the Railway Business Association and in the same year he was appointed secretary and treasurer of the Association of Manufacturers of Chilled Car Wheels, which position he held until October 27, 1914, when he was elected president, with headquarters at Chicago.

# TRADE PUBLICATIONS

Sand Drying Equipment.—The Roberts & Schaefer Company, Chicago, has issued an eight-page bulletin descriptive of its railroad sand drying equipment.

Boston Gears.—Specifications and prices of some new styles and sizes of Boston gears are given in circular C3-24 recently issued by the Boston Gear Works, Norfolk Downs, Quincy, Mass.

Alloy Steels.—A 48-page, illustrated handbook covering Agathon alloy steels and containing a number of tables of data of interest to metallurgists and engineers, has been issued by the Central Steel Company, Massillon, Ohio.

Sectional Condenser.—A condenser, built in two or more sections and designed to operate either as a standard, reflux, or partial condenser, or as a condenser and heat exchanger at the same time, is described in Form 198 issued by the Griscom-Russell Company, New York.

Locomotive Feed Water Heaters.—Spare parts lists for feed water heater condensate return tank parts and washout apparatus parts have been issued by the Superheater Company, New York, in the form of Bulletins H-3-a and H-3-b, respectively. Each of the parts are illustrated.

Oil Engines.—General specifications for Foos oil engines, Type R, are given in an eight-page bulletin, No. 704, recently issued by the Foos Gas Engine Company, Springfield, Ohio. Other types of Foos oil and gas engines are illustrated and briefly described in bulletin No. 705.

Electric Lift Trucks.—Bulletin No. 5-A, descriptive of an electric lift truck and skid system for industrial transportation, has been issued by the Cowan Truck Company, Holyoke, Mass. On pages 10 and 11 particular reference is made to the application of the Cowan truck to railway service.

Power Units for Rail Cars.—Detailed information concerning the construction and operation of Oneida power units for gasoline rail cars used on either standard or narrow gage railroads, is given in an illustrated catalogue recently issued by the Oneida Manufacturing Company, Green Bay, Wis.

Power Reverse Gear.—On page 649 of the October issue of the *Railway Mechanical Engineer* mention was made of the issuance of bulletins Nos. 227-A and 228-A, descriptive of the Ragonnet power reverse gear, by the Franklin Railway Supply Company, New York. This was in error as bulletin No. 227-A has been discontinued.

Chain Grate Stokers.—A complete discussion of both the Type A (natural draft) and Type G (forced draft) Illinois chain grate stokers is given in a 62-page catalogue recently issued by the Illinois Stoker Company, Alton, Ill. An array of blueprint drawings illustrate the use of both the forced and the natural draft chain grate stokers in connection with all of the principal types and makes of boilers.

Safety Valves.—Sectional drawings, showing the construction and operation of automatic cushioned altitude valves for maintaining a uniform water level in tanks, standpipes and reservoirs, regardless of climatic conditions, are shown in print No. 801, recently issued by the Golden-Anderson Valve Specialty Company, Pittsburgh, Pa. Other types of Golden-Anderson safety valves are illustrated in a 16-page booklet.

Locomotive Grates.—The construction, the shaking action and the economies derived from the adoption as standard equipment of the Hulson locomotive grate are fully described in a 19-page, illustrated booklet just issued by the Hulson Grate Company, Inc., Keokuk, Iowa. First the shaking action of the Hulson grate is described and illustrated by means of line drawings. On pages eight and nine will be found a description and illustrations of the pocket openings. The middle folio of the book contains a reprint of a blue print showing a typical general arrangement for a Mikado type locomotive. This is followed by a description and photographs of the various parts that make up the grate. On the last page will be found a summation of ten advantages of the Hulson grate.

# PERSONAL MENTION

## General

W. P. Rudd has been appointed general foreman, mechanical department, of the Pennsylvania, with headquarters at Pittsburgh, Pa., succeeding G. H. Burton.

A. R. Sykes, formerly general foreman of the shops and roundhouse of the Illinois Central at Jackson, Tenn., has been appointed assistant inspector of equipment of the Missouri Pacific System, with headquarters at St. Louis, Mo.

G. H. Burton, general foreman in the mechanical engineering department of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been promoted to assistant engineer of motive power, with the same headquarters, succeeding W. P. Rudd.

W. W. Atterbury, vice-president in charge of operation of the Pennsylvania, has been elected vice-president, a new position made necessary by the approaching retirement of President Rea, which is scheduled for next year. General Atterbury will assist President Samuel Rea in the discharge of his duties and in the several important improvement projects which the company has in view, and will act as president in Mr. Rea's absence.


W. W. Atterbury

General W. W. Atterbury was born at New Albany, Ind., in 1866. He completed his education at Yale University in 1886. The same year he entered the Pennsylvania's service as an apprentice in the Altoona shops, and later served as assistant road foreman of engines on various divisions, assistant engineer of motive power and master mechanic. In 1896 he became superintendent of motive power of the Pennsylvania Lines East. In 1910 he became a general superintendent of motive power. On January 1, 1903, he was appointed general manager of the Lines East, and on March 24, 1909, was elected fifth vice-president in charge of transportation. He became fourth vice-president on March 3, 1911, and at the same time was elected a director of the Pennsylvania Railroad Company. On May 8, 1912, he was elected vice-president in charge of operation of the Lines East of Pittsburgh. From August, 1917, to May, 1919, he was director-general of transportation of the American Expeditionary Forces in France, with the rank of brigadier-general, and in that connection had charge of the details of organization for the construction and operation of the American transportation requirements, as well as harmonizing them with those of the allies. Since the return of the railroads to their owners upon the termination of federal control, General Atterbury has been vice-president in charge of operation of the entire Pennsylvania System.

## Master Mechanics and Road Foremen

O. C. Branch has been appointed assistant road foreman of engines of the Seaboard Air Line, with headquarters at Hamlet, N. C.

Edward B. LeVan, road foreman of the Northern Pacific, with headquarters at Missoula, Mont., has been transferred to Livingston, Mont.

H. Y. Harris, general foreman of the car department of the Seaboard Air Line at Tampa, Fla., has been appointed master mechanic of the Florida division, with the same headquarters, a newly created office.

C. F. PARKER has been appointed master mechanic of the Kansas City Southern, with headquarters at Heavener, Okla., succeeding F. A. Prewitt.

B. G. PAULEY has been appointed master mechanic of the Omaha division of the Chicago, Burlington & Quincy, with headquarters at Omaha, Nebr.

L. A. OSTEEN has been appointed assistant road foreman of engines of the Florida division of the Seaboard Air Line, with headquarters at Wildwood, Fla.

LUKE J. GALLAGHER, engineer of the Rocky Mountain division of the Northern Pacific, has been promoted to road foreman, with headquarters at Missoula, Mont.

W. T. PINNER has been appointed assistant road foreman of engines of the South Carolina division of the Seaboard Air Line, with headquarters at Jacksonville, Fla.

## Car Department

D. M. RAYMOND has been appointed general car foreman of the Union Pacific, with jurisdiction over the car and electric departments at Council Bluffs, Iowa, and Omaha, Nebr. Mr. Raymond entered the bridge and building department of the Union Pacific at Laramie, Wyo., in 1908. The following year he was transferred to the mechanical department. In 1911, he returned to the bridge and building department, in August, 1913, being again transferred to the mechanical department where he served successively as car repairer, inspector, head inspector, and assistant foreman. In September, 1921, he was appointed car foreman at Green River, Wyo., which position he held until his appointment as general car foreman.

D. M. Raymond

## Shop and Enginehouse

W. P. HARTMAN has been appointed roundhouse foreman of the Atchison, Topeka & Santa Fe, with headquarters at Albuquerque, N. M.

T. L. HARTSOCK, night foreman of the East Altoona enginehouse of the Pennsylvania, has been appointed day foreman, succeeding B. K. Stewart.

T. W. LOWE, assistant general foreman of the Columbus shops of the Pennsylvania, has been promoted to general foreman, succeeding R. F. Lace, deceased.

J. SCHNEEBERGER, gang foreman of the Chicago and Alton, has been appointed general erecting shop foreman, with headquarters at Bloomington, Ill., succeeding A. B. Erickson.

T. H. BUTLER, night roundhouse foreman of the Illinois Central at Jackson, Tenn., has been promoted to day roundhouse foreman, with the same headquarters, succeeding R. W. Wilcox.

D. C. CHERRY, gang foreman of the Juniata shops of the Pennsylvania, has been appointed night enginehouse foreman of the East Altoona enginehouse, succeeding T. L. Hartsock.

GEORGE F. ADAMS, shop superintendent of the Boston & Maine at Keene, N. H., has resigned, after more than 53 years of service. Mr. Adams was born in Nashua, N. H., April 16, 1855, and graduated from the Nashua high school, becoming an engine wiper in the old Nashua & Lowell enginehouse at Nashua in October, 1870. He subsequently served as locomotive fireman, blacksmith's helper and blacksmith, holding the latter position for nine years. During this time, because of illness, he also served for one year as clerk in the shop office, cashier at the freight house, foreman at freight house, yard clerk and passenger and freight brakeman. In 1883 he was appointed foreman blacksmith, five years later becoming assistant to the general foreman, and in June, 1890, general foreman, in charge of engine dispatching, freight car repairs, car inspection and general maintenance of way repair work. In 1914 he was transferred to Keene, and in 1923 was promoted to shop superintendent.

L. P. LIGON, inspector of shops and equipment of the Norfolk & Western, retired recently after having been in the service of the company for about 50 years. Mr. Ligon was born in Powhatan County, Va., on July 2, 1858. In 1869 he moved to Lynchburg, Va., and at the age of 16 became a machinist apprentice on the Atlantic, Mississippi & Ohio at Lynchburg, in which capacity he served until 1878. He then worked as a machinist until May, 1886, when he was promoted to foreman. In December, 1885, he was transferred to East Radford, Va.; in January, 1893, promoted to master mechanic of the Radford division, with headquarters at Radford; in March, 1894, transferred to the Pocahontas division; in September, 1904, appointed master mechanic of the General Eastern division; in February, 1918, appointed master mechanic of the Shenandoah division; in January, 1919, appointed master mechanic of the Shenandoah and Norfolk divisions; in August, 1919, appointed master mechanic of the Shenandoah division, and in January, 1923, appointed inspector of shops and equipment.

## Purchasing and Stores

J. G. HILGEN has been appointed storekeeper of the Chesapeake & Ohio, with headquarters at Richmond, Va.

C. E. BRANSON has been appointed storekeeper of the Chesapeake & Ohio, with headquarters at Russell, Ky.

J. W. COCKRILL has been appointed division storekeeper of the Illinois Central, with headquarters at Clinton, Ill., succeeding R. E. Downing, who has resigned to engage in other business.

J. L. QUARLES, storekeeper of the Chesapeake & Ohio at Richmond, Va., has been promoted to assistant general storekeeper, with headquarters at Clifton Forge, Va., succeeding A. H. Young, Jr., who has been assigned to special work.

## Obituary

R. F. LACE, general foreman of the Columbus shops of the Pennsylvania, died on September 9.

F. C. HAMILTON, general roundhouse foreman of the Atchison, Topeka & Santa Fe, at Albuquerque, N. M., died recently at Kansas City, Mo.

FREDERICK S. GALLAGHER, engineer of rolling stock of the New York Central, with headquarters at New York, died on October 26 at St. Luke's Hospital, Yonkers, N. Y., from complications. Mr. Gallagher was born on August 1, 1871, at Tecumseh, Mich., and received a common school education at Plattsmouth, Nebr. He entered the service of the New York Central on September 17, 1900, as a draftsman in the office of the mechanical engineer at Collinwood, Ohio. Four years later he left the service of the New York Central, returning in 1906 to his former position. On October 1, 1905, he became chief draftsmen in the office of the assistant engineer of motive power at Collinwood and in 1911 he was appointed assistant engineer in the office of the general mechanical engineer at Grand Central terminal, New York. He was promoted to assistant engineer of rolling stock and motive power on July 1, 1917, and on June 1, 1920, he was promoted to engineer of rolling stock, which position he held at the time of his death.

F. S. Gallagher